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# **Essays in Behavioural Economics**

**By**

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Thesis submitted in partial fulfilment of the requirements for  
the degree of Doctor of Philosophy

University of Warwick, Warwick Business School  
Behavioural Science Group

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## **Dedication**

*To my Parents, Bernadette and Michael*

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## **LIST OF ABBREVIATIONS**

AAC – the Acquiring a Company Game/Task

ACQ – Attention Check Question (manipulation check)

AIRO – Association of Irish Racehorse Owners

BHA – British Hospitality Association

CVA – Common Value Auction

ERAR – Eligibility Requirements Approval Rate

eWOM – Electronic Word of Mouth

IPO – Initial Public Offering

JEL – Journal of Economic Literature (Classification)

MBA – (Participant undertaking a) Masters in Business Administration

OLS – Ordinary Least Squares

OSC – Outer Continental Shelf

PA – Prolific Academic

RSE – Robust Standard Error

SRQA – Self Reported Quantitative Ability

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David Butler

December 2017

## **DECLARATION**

I certify that the thesis I have presented for examination for the degree of Doctor of Philosophy is my own work with the exception of collaborative research on Essay Three, where I have written the vast majority of the essay.

No component of this thesis has been submitted for a degree at another university. Full acknowledgment of the thesis is expected if the work is cited. No components may be reproduced without my consent. I declare that my thesis consists of 49,834 words.

## **Conference, Seminar & Upgrade/Review Declarations**

Various parts of this thesis have been presented over the course of my doctoral registration. The experimental model and design in Essay One was presented at the School of Economics Winter Research Symposium on the 12<sup>th</sup> of December 2014 in University College Cork, Ireland. Essay Two was presented twice; firstly, at a research seminar in University College Cork on the 18<sup>th</sup> of May 2016 and secondly at the 8<sup>th</sup> ESEA Conference in Groningen University, Netherlands on the 1<sup>st</sup> of September 2016. Essay Three was presented on the 7<sup>th</sup> of December 2016 at a lunchtime research workshop in University College Cork and an overview of my disclosure research was presented at the Cork University Business School Winter Research Symposium on the 6<sup>th</sup> of December 2017. Many components of the thesis have been presented at annual upgrade/review presentations since June 2014 in the University of Warwick.

## **Research Training**

As part of my registration I have undertaken taught courses in Quantitative and Qualitative Research Methods, Philosophies of Social Science Research and Practice of Social Research. I was awarded a *Postgraduate Certificate in Social Sciences Research* on the 14<sup>th</sup> of December 2015. In addition, I have undertaken coursework in Game Theory and have attended the Warwick Behavioural Science Summer School in July 2014 and July 2017.

## SUMMARY

This thesis analyses decision making through the lens of behavioural economics.

The three essays within consider variants of adverse selection problems and psychological biases which can manifest from imperfections in an information structure. The predominant psychological theory is informed by the idea of bounded awareness; one's tendency to make suboptimal decisions through overlooking important information.

The first essay concerns the *winner's curse* in bargaining. The second essay assesses bidding behaviour in an auction environment. The third essay considers disclosure decisions. The general findings are as follows:

- (i) Research on the *winner's curse* grew significantly since 1980 and peaked in 2009. The seminal work of William Samuelson and Max Bazerman in 1985 extended the concept to a new domain of bilateral bargaining and inspired fifteen further experimental studies. I demonstrate that costless nonbinding signals complicate decision-making but that alternative forms of cheap talk do not statistically influence bidding strategies. Secondly, I show that individuals find it challenging to strategically avoid information, exhibiting difficulties in performing contingent reasoning in bargaining.
- (ii) Analysing bidding efficiencies in high stakes and competitive auctions, I find that 80% of thoroughbred foals sold realise negative returns. The scale of losses is amplified as winning bids increase. On average, once a winning bid increases above €20,000, the assets enter the domain of losses. Incompatible incentives between stakeholders and diversification strategies fail to explain

the inefficiencies. Although multiple interpretations of the findings exist, the results are consistent with the *winner's curse* hypothesis and incompatible with the idea of profit maximisation.

- (iii) Investigating the unravelling principle in the hospitality industry, I find that the strict equilibrium prediction does not occur. A partial unravelling result is reported. The major finding is that a downward linear relationship exists between TripAdvisor signals and voluntary disclosures by hotels. Low ranked hotels tend to hide ratings information. Higher rank hotels are more likely to make a voluntary disclosure when compared to the lowest ranked. This raises ethical questions if consumers have psychological blind spots.

## 1. INTRODUCTION

This thesis consists of three essays in behavioural economics. The aim of the essays is to provide an original contribution to knowledge in this sub-field. *Generally*, I consider strategic decision making and appeal to models of, and concepts relating to, adverse selection. *Specifically*, I consider projection biases in bargaining, auction and consumption settings which exhibit alternative informational properties. In many respects, the bargaining, bidding and consumption settings considered within this thesis represent examples of the basic activities of economic life (Camerer, 2003)<sup>1</sup>. As the interactions explored throughout the three essays are characterised by interdependent parties, joint decision making strategies and alternative preferences, the general theme of this work is classified as *negotiator cognition* (Bazerman & Moore, 2009).

Each essay represents an interdisciplinary project, drawing on both the disciplines of economics and psychology. Thus, the thesis straddles classifications. It falls under the remit of *Behavioral Microeconomics* (JEL: D03) but can extend to both a classification of *Asymmetric and Private Information* (JEL: D82) and *Game Theory and Bargaining Theory* (JEL: C7). The markets studied are diverse. The thesis therefore has specific applications to, and implications for, niche industries and research areas. Examples include the tourism and sports industries.

This introduction serves four purposes. Section 1.1 outlines the *scope* of the three essays by suggesting unifying features of the content. This places boundaries on the subject matter. I focus on defining the most important psychological and economic

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<sup>1</sup> While the terms ‘bargaining’ and ‘negotiation’ are used interchangeably throughout this thesis, the former term was historically reserved for purely economic research while the latter emerged from research in applied psychology. A common distinction is that the latter often involves an unstructured approach to bargaining.

concepts that tie the essays together. Section 1.2 describes the overarching *philosophical standpoint* of the thesis, demarcating an explicit scientific approach. This provides a brief opportunity to address epistemological issues. Section 1.3 outlines the broad goals of the thesis and offers a general *rationale*, detailing the motivating factors for the research in light of historical and recent developments in behavioural economics and information economics. In particular, this section offers an opportunity to discuss why the topics within this thesis are worthy of study, certifying the purpose and relevance of the research area. The final objective of the introduction is to provide a *practical guide* for what is to follow. This is included as the thesis contains diverse methods, data sources and domains of study. Section 1.4 offers a brief overview of the methods and data used while Section 1.5 provides a synopsis of three essays<sup>2</sup>. Section 1.6 explains the form and structure of the essays. This involves providing practical information on the timeline of the thesis and background information relating to how the essay topics were generated.

## 1.1 Scope

It is important to identify unifying features within the essays and to set boundaries to the content of this thesis. While the settings studied throughout are diverse, ranging from simulated experimental markets to natural auction and market environments, the content is unified by distinct psychological and economic theory. Each essay assesses a scenario where adverse selection problems arise and considers resulting psychological biases which can manifest from imperfections in an information structure. The target environments in essay two and three, which may appear diverse on first inspection, are carefully selected and studied to ensure they provide an

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<sup>2</sup> The precise implications of the individual essays and the exact contributions to knowledge do not occur here and are reserved for each essay.



appropriate setting. The two unifying features are discussed now, beginning with the psychological theory.

### ***Bounded Awareness***

The psychological insights imported to study the scenarios addressed in the forthcoming essays are drawn from research on bounded awareness, applied to economic settings (Chugh & Bazerman, 2007). Bounded awareness occurs when an individual fails to perceive and use information that is important to making a choice or excludes information by placing “arbitrary and dysfunctional bounds” around the definition of a problem (Bazerman & Tenbrunsel, 2011 p.7). As a behavioural bias, bounded awareness can be placed alongside a wider family of other failures of visual awareness such as *change blindness* (Simons & Levin, 1997; Simons & Rensink, 2005) and *inattentional blindness* (Simons & Chabris, 1999).

The basic concept has overlapping features with other behavioural biases, most notably, the *availability bias* (Tversky & Kahneman, 1974). As suggested by Bazerman and Moore (2009 p.61) “both concepts confront the fact that important information often remains unavailable to the decision maker”. The distinguishing feature of bounded awareness is that it “examines the specific groups of variables that are likely to be in or out of focus in specified domains”. For this thesis, the information content held by another agent is the variable “out of focus”.

Table 1.1 demonstrates how the overarching psychological concept of bounded awareness is applicable to each essay. Each of the three applications involve the general failure of perspective taking.

**Table 1.1 Bounded Awareness by Essay**

<b>Essay</b>	<b>Economic Context</b>	<b>Bounded Awareness</b>
<b>Essay 1</b>	Bilateral Bargain	Individuals may fail to make rational strategic inferences based on the information structure of a game.
<b>Essay 2</b>	Auction	Individuals may fail to adjust for the information content of competitors' signals.
<b>Essay 3</b>	Consumer Decision Making	Individuals may fail to observe or underestimate the implication of non-disclosure of quality information.

As Thaler (1992 p.62) surmises “the key ingredient is the existence of a cognitive illusion, a mental task that induces a substantial majority of subjects to make a systematic error...whenever such an illusion can be demonstrated, the possibility that market outcomes will diverge from the predictions of economic theory is present”. This thesis argues that such errors are common in the economic contexts identified in Table 1.1.

Thus, the theme of negotiator cognition, with an emphasis on how decision makers interact with an information environment, often naively, will surface across the markets examined. Although it is important to note that ideas relating to individuals facing limitations in the amount of information they can process is old, a contemporary review of the findings relating solely to judgemental failures in a negotiation context is provided by Bazerman and Chugh (2005)<sup>3</sup>.

### ***Adverse Selection – The Basics & Variants***

An investigation of bounded awareness, insofar as it concerns adverse section problems, is the primary focus of this thesis. The potential for adverse selection effects is an important feature of the three domains researched. While the thesis predominantly concerns variants of the basic adverse selection problem initially

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<sup>3</sup> Simon (1955) represents a notable early identification of the general problem at hand.

conceived by Akerlof (1970), it is important to define the class of situations adverse selection seeks to address. This is required as the variants I explore hold key properties of the original and simple problem (Ball, Bazerman & Carroll, 1991).

In lay terms, adverse selection involves lying during a negotiation in an attempt to further one's own interests. Private information, that is asymmetric, is a precondition of such behaviour<sup>4</sup>. This intuition is premised on a standard economic account of exchange which implies that if sellers and buyers have opposing incentives, a seller will pursue profit by selling products that are inexpensive to produce at the highest price possible. Oppositely, consumers desire the highest quality goods in light of their preferences and budget constraints. When this incentive structure is accompanied by unequal knowledge of product quality between a buyer and a seller, opportunistic behaviours can emerge. Despite the presence of incompatible incentives an agreement could be reached that leaves both parties better off.

In contrast to the intuitive description of the problem, a technical definition of adverse selection conceives it as pre-contractual opportunism characterised by an informed agent benefiting from a trade or contract with a less informed agent, who is not privy to unobserved characteristics. This general problem of adverse selection has a distinct market implication; Pareto inefficiencies can come about as a consequence of an information environment characterised by latent private information and thus unobservable quality. A Walrasian equilibrium is not reached as asymmetric information exists (Molho, 1997)<sup>5</sup>.

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<sup>4</sup> Asymmetric information can also lead to problems in markets outside of adverse selection, most notably, moral hazard (post-contractual opportunism).

<sup>5</sup> Molho (1997) provides a formal statement of the model described.

This abstract logic has a general application, a characteristic which determined the influence of Akerlof's (1970) contribution (Sandmo, 2011). The appeal of the model lies in its ability to invite one to infer that similar processes, where exchange is positively related to the symmetry of information, can occur across markets. While the assumptions underpinning the model are restrictive, they represent human motivations and behaviour as it occurs in 'real world' markets (Sugden, 2000).

To overcome this type of information problem both parties in a trade typically enter a negotiation, adopting strategic mechanisms to avoid impasse and achieve gains from trade. In its most basic form this negotiation is a process of "managing information in order to resolve conflicts of interest" (Lewicki & Polin, 2013 p.176). This practise occurs as individuals deem negotiation a more efficient means to resolve a dilemma than acting independently.

The three variations of adverse selection investigated throughout this thesis are derived from this core problem and are sketched below.

### ***The Winner's Curse in Bilateral Bargaining***

The first version of adverse selection in Essay One relates to an experimental model of the problem identified by Akerlof (1970). The form of adverse selection evaluated is considered extreme as it is premised on a strict prediction derived from an experimental model. In this model, a normative analysis predicts that the decision-maker should refrain from entering a negotiation in light of the structure of the trade faced. Past research suggests that individuals commonly suffer from the *winner's curse* in these bilateral bargains and naively bid when presented with an extreme 'lemons' problem. The form of information asymmetry is pure as there is no way for a decision maker to learn valuable information without engaging a more informed

party. In Essay One, this model is reviewed and manipulated to produce insights from both the buyer and seller side of a negotiation.

### ***Auction Environments & Adverse Selection***

The second essay explores high-stakes and competitive auctions which have strict and unique information conditions. Namely, no leakages of information regarding the true value of the asset are possible at the time of sale. This is a context in which the *winner's curse* was first conceived and provides a relatively appropriate target environment to consider bidding strategies involving experienced bidders. Thaler (1988) provides an accessible introduction to the topic of naïve bidding in the context of auctions and Harrington (2009) details a formal model of the problem. The setting is carefully chosen and represents a relatively rare opportunity to analyse bidding in an auction environment where the true value can be assigned to an asset ex-post.

### ***The Unravelling Principle & Adverse Selection***

The third essay considers the potential for adverse selection in spite of competitive market pressures initiating a signalling mechanism. I suggest that partial unravelling can form a fertile environment for adverse selection in light of cognitive limitations faced by consumers. These bounds on consumer reasoning are informed by psychological theory. In theory, consumers should make smart inferences when non-disclosure occurs. I challenge these inferences imposed on consumers. In turn, this has ethical implications relating to disclosure decisions for firms. An intuitive explanation of the unravelling results is offered by Frank (1988) and most recently in a consumer context by Sah and Read (2017a). The most recent formal treatment of information revelation and the unravelling result is provided by (Riley, 2012).

Table 1.2 details the nature of the information environment for the three essays, providing an explanation of how each problem explored deviates from the basic adverse selection model.

**Table 1.2 Adverse Selection – Variations & Description by Essay**

<b>Essay</b>	<b>No. of Agents</b>	<b>Economic Context</b>	<b>Information Environment</b>	<b>Explanation</b>
<b>Essay 1</b>	2	Bilateral Bargain	Pure Information Asymmetry	Sellers have a distinct information advantage over buyers - a extreme version as selective acceptance will occur, resulting in losses on average
<b>Essay 2</b>	$\geq 2$	Auction	Impure Information Asymmetry	Partial but strictly limited knowledge of the true value is known by <i>both</i> sellers and buyers
<b>Essay 3</b>	2	Consumer Decision Making	Impure Information Asymmetry	Sellers have full knowledge of their quality. While this is accessible to buyers, they may or may not opt to acquire this information

## 1.2 A Brief Epistemological Note

As a sub-discipline, behavioural economics proposes limits on human rationality in general domains. Two specific findings stand out which are important to this thesis. The first concerns general constraints on the level of strategic thinking humans can reach. A second relates to individuals' imperfect understanding and interpretation of game-theoretic situations. In the main, the findings suggest that (i) individuals fail to practise optimal strategic reasoning and, (ii) individuals fail to interpret game-theoretic scenarios appropriately. These results are based on empirically grounded research, hinging upon theoretical assumptions of expected behaviour (Camerer, 2003).

This thesis follows a similar scientific approach by considering these confines; rational choice and logical outcomes are often the starting point of analysis (Kahneman, 2003; Sent, 2004). By anchoring decision making on rational choice, one has an expository device to investigate deviations from optimal decision-making. This is the tradition in which this thesis proceeds. In the context of the essays that follow, rational choice is commonly defined by an agent's ability to make appropriate strategic inferences.

Although many parts of the thesis consider behavioural biases, rational choice is a powerful analytical tool. It can classify criteria for normative decision-making and offers a valuable methodological instrument to study psychological variables important to adverse selection. By appreciating rational choice, one has a clearer prediction of expected behaviour. Rational theories act as a yardstick from which to measure systematic deviations. As a scientific approach, this method can be labelled as an error-based style to researching decision making.

As is the intention with the vast majority of research in behavioural economics (that follows a similar methodological approach), this thesis does not aim to displace any incumbent microeconomic theory or invalidate game theoretic constructs.

Commonly, the falsification of normative theory through experimental means, or otherwise, in the social sciences has an alternative end to that of the natural sciences as it allows for the modification of a theory in light of new evidence. Consequently, researchers can improve the descriptive and/or predictive capacity of models. As Smith, (1994, P.129) suggests "when a theory works well, they [experimental economists] push imaginatively to find deliberately destructive experiments that will uncover its edges of validity, setting the stage for better theory and a better understanding". This is a common sentiment advocated by thinkers in the field. A

similar claim is expressed by Camerer (2003), who implies that the goal of experimenting with and testing game-theoretic models is not to refute microeconomic theory but rather to improve its explanatory power and predictive capacity to inspire new theory. When novel findings that deviate from strict predictions are observed, the idealised rational choice model becomes more descriptively complex and less driven by theoretical impositions. ‘Failures’ or ‘errors’, can reveal a representative agent of greater dimensionality.

In sum, the purpose of identifying idiosyncrasies in decision making is not intended to be a substitute but rather a complement to the traditional tools of the social scientist. The representative agent, embedded in textbooks, can become “a more rounded and interesting ‘fatter’ character – a man who can learn, bargain, act strategically, has memory, and may even be happy” (Morgan, 2012 p.166).

### **1.3 A General Rationale**

The roots of the intellectual connection between psychology and economic theory concerning information are deep. The confluence of the themes are arguably the basis of one of the most important works in economics (Akerlof & Yellen, 1987)<sup>6</sup>. Since the 1960’s, following the initial relaxation of the perfect information assumption (Stigler, 1961), economists have paid increasing attention to the role of information in markets. They have focussed on information’s form, absence, and mechanism of communication. A specific focus has been placed on how one’s access to information should be an important determinant in decision-making. The application of theories emerging from this paradigm of research have varied over

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<sup>6</sup> George Akerlof and Janet Yellen (1987) draw an explicit connection between the contributions of John Maynard Keynes in his *General Theory of Employment Interest and Money* to findings on informational biases.



time, with the most prominent extensions arising in the domains of labour and finance (Lofgren, Persson, & Weibull, 2002). A fusion with psychological concepts is a natural extension.

Pursuing research at this intersection is not reserved to the contribution of landmark historical works. It is important to stress that this intersection has been identified as worthy of fresh insights by contemporary thinkers (Stiglitz, 2002; Akerlof, 2002)<sup>7</sup>.

The need to use psychology to highlight and develop upon the failures of information economics, which commonly applies rational models, is a ripe research area (Stiglitz, 2017). With such ideals in mind, this thesis seeks to increase the precision of association between microeconomic models, insofar as they concern information, and psychology. Strengthening these connections and providing an increasingly precise and psychologically plausible description of individual behaviour in specific markets is the primary motivation for this thesis.

Pursuing this goal involves following a distinctly empirical approach. For the field studies (Essay Two and Essay Three) there is a specific emphasis placed on building sizeable datasets to allow increasingly precise measurement. Sections of literature, as seen in Essay One, are also data driven. This is a core goal of the thesis - developing and strengthening the connection between psychological approaches in economics by providing unique datasets that are unrivalled in terms of their size by previous research in the specific markets under analysis.

Another broad motivation for this thesis is to conduct research in a nascent area in behavioural economics. As a branch of the research agenda, spaces such as the

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<sup>7</sup> This is particularly pertinent given that the intellectual backdrop in economics that is favouring 'softer' regulatory measures, involving information provision and disclosure policies, as solutions to economic problems characterised by misaligned incentives (Camerer, Issacharoff, Loewenstein, O'Donoghue & Rabin, 2003; Sah, Cain & Loewenstein, 2013).

*(behavioural) economics of disclosure*, which are intrinsically linked to the impact of information, have recently been identified as underdeveloped and worthy of further psychological insights (Loewenstein, Sunstein & Golman, 2014). In particular, the systematic occurrence of bounded awareness has been argued as an underexplored aspect of judgmental failure in this context (Bazerman & Chugh, 2005). The unfledged nature of this branch of the research agenda is an attractive feature and served as another general motivating factor.

A final motivating factor is to offer practical insights to specific industries. As past research has shown, conducting analysis at the intersection of psychology, information and economics holds everyday implications in many settings. In particular, the insights can usually be applied to a managerial setting (Bazerman & Moore, 2009; Goldfarb, Ho, Amaldoss, Brown, Chen, Cui, & Xiao, 2012). The findings in Essay Two and Essay Three have practical applications to the sports and tourism industry. Essay Two has specific implications for the thoroughbred horseracing industry. As Essay Three concerns consumer decision-making, the findings offer a basis to inform policy, a common end goal of behavioural decision research (Milkman, Chugh & Bazerman, 2009).

#### **1.4 Methods & Data**

Two methods of investigation are adopted, both of which are empirically based. The first method is grounded on experimental tests. These seek to simulate a controlled negotiation environment. Later parts of Essay One incrementally change an experimental adverse selection model. This is operationalised in an experimental setting with the aim of testing new hypotheses. Secondly, as the later essays consist of field studies, traditional regression analysis is used as a method of investigation. These approaches involve estimating differences and causal relationships using a

variety of statistical and econometric techniques. The methods are applied to datasets which are assembled manually over the course of the thesis. Specifically, the econometric analysis involves using Quantile and Huber regression models (Essay Two) and Binary Response Models in light of a disclosure decision being a dependent variable (Essay Three).

Data for this thesis are derived from multiple sources. In Essay One, data are acquired through individual choice tasks in an experimental setting. Bibliographic data are also accessed when surveying the topic of the *winner's curse* in bilateral bargaining. For Essay Two and Essay Three data are sourced from online resources. These data are extracted via a manual page 'web scraping' method. This involved extracting publically available information and transferring it into a local dataset to make it amenable to analysis. The second essay and third essay involve the construction of expansive datasets to consider naturally occurring markets. This encompasses the assembly of detailed information on 1,681 (Essay Two) and 4,357 (Essay Three) observations, respectively. Both datasets are constructed in an effort to align laboratory conditions with relatively appropriate target environments. In and of themselves, these datasets offer a contribution due to their uniqueness.

## **1.5 An Overview of the Forthcoming Essays**

This section provides a synopsis of the forthcoming essays. This is intended to outline the highlights of each essay and provide an abstract to the forthcoming work.

### **Essay 1 - *Thirty Years of Acquiring Companies: A Review of the Winner's Curse in Bilateral Bargaining***

- I synthesise the findings of sixteen experimental tests of the *winner's curse* in bilateral bargaining.

- Optimal bidding strategies are typically adopted by under 10% of participants.
- Opportunities to learn have a minimal effect on bidding strategies.
- Training and group decision making can soften the bias.
- I conduct two small-scale experiments to investigate the influence of (i) cheap talk and (ii) seller's ability to strategically avoid information.

This essay contributes to the behavioural science literature by synthesising and reviewing experimental tests of the *winner's curse* in the setting of bilateral bargaining. Since the original findings of Samuelson and Bazerman (1985), fifteen further studies have experimentally tested the phenomenon in the extended domain of bilateral bargaining. Following thirty years of research on the problem, this study considers the origins of the bias and assesses the robustness of naive bidding behaviour. Extensions to the basic experimental model which address the impact of learning and communication are reviewed before alternative explanations for suboptimal bidding are considered. I discuss several applications of the adverse selection problem and conduct two small-scale experiments to provide insights to both buyer and seller psychology in the game.

**Essay 2 - Winner Alright? High-Stakes Bidding and Returns to Ownership in the UK and Irish Thoroughbred Horseracing Industry**

- 80% of the assets sold at auction realise negative returns.
- Once a winning auction bid increases above €20,000, on average, the assets enter the domain of losses.
- This scale of loss is amplified as winning bids increase.
- Incompatible incentives and diversification strategies fail to explain the inefficiencies.
- Although multiple interpretations of the findings exist, the results are consistent with the *Winner's Curse* hypothesis.

This essay conducts an ex-post productivity evaluation of 1,681 thoroughbred foals sold between 2007 and 2008 in high-stakes UK and Irish public auctions. Such auctions offer a unique natural context to study competitive bidding behaviour as each assets yield can be measured. The results provide empirical weight to a commonly held belief - a high percentage of thoroughbreds incur net negative returns. The scale of losses is amplified as winning auction bids increase. Huber (robust) and quantile regression models are estimated to determine the factors associated with each assets net returns. Alternative behavioural arguments, to explain the inefficiencies, are given consideration. These do little to explicate the losses. In light of the findings, I offer conjectural explanations for the pattern that can form the basis of further research.

### **Essay 3 - Unravelling & Strategic Disclosure: Evidence from the Hospitality**

#### *Industry*

- I study the frequency of voluntary *TripAdvisor* disclosures by hoteliers regionally and internationally.
- Contrary to a strict unravelling result, an incomplete level of disclosure is observed.
- A linear relationship is detected with lower ranked hotels displaying a tendency to veil their *TripAdvisor* rating.
- Two additional datasets allow one to probe emerging questions relating to the sales medium and consumer expectations.

I consider strategic disclosure and test the unravelling principle in a new market by analysing *TripAdvisor* rating admissions made by hoteliers internationally and regionally (in the United Kingdom and Republic of Ireland). I construct two unique datasets and verify disclosure decisions for 4,357 hotels across 22 locations globally. These measures are established from 4,060,830 *TripAdvisor* reviews. The major

finding is that a downward linear relationship exists between *TripAdvisor* scores and voluntary disclosures, both regionally and internationally. The strict equilibrium prediction, that all information will be revealed, does not occur. Whilst an unravelling process is initiated through the disclosure of high-quality signals, a substantial degree of low level disclosure fails to transpire. Evaluating interactions between *TripAdvisor* ratings and internal certification (star ratings) indicates that the latter may serve as a reference point for a disclosure decision. I compile two supplementary datasets to answer ancillary questions that arise from the primary findings. The first is from holiday catalogues and shows that *TripAdvisor* disclosures increase considerably in a simpler decision-making context where choices are easily comparable and non-disclosure is salient. The second is from *Trustpilot* - a nascent third-party signalling mechanism based on electronic word-of-mouth (eWOM). This data reveals a similar disclosure pattern in a domain where the expectation of a disclosure is questionable. The essay concludes by arguing that the findings have implications for guest experiences and ethics in the industry, given the challenges consumers face observing information gaps.

## **1.6 Essay Background & Further Information**

The placement of the essays within this thesis reflect the chronological order in which the ideas were generated. The ideas explored in the first essay can be traced to conversations on the 14<sup>th</sup> of February 2014. The first essay characterises the first two academic years of doctoral research where experimental inquiry was the primary focus. In many respects, this first essay attempts to show evidence of a deep literature review and is based on research in earlier years of research. Included in this essay are two small-scale experiments that are a product of interesting questions arising during discussions of the adverse selection puzzle.

The second essay derived from theory important to Essay One. Learning about past experimental and field studies on the *winner's curse* stimulated the idea for the second essay. In 2015, I focussed on finding appropriate target environments to consider naïve bidding strategies. Naturally, I also required a context where data was accessible. Essay Two commenced in 2015 and involved a significant period of data collection, cleaning and coding.

The kernels of the third essay can be traced to the 18<sup>th</sup> of April 2016. This is when I was introduced to the unravelling principle during an MBA session in Warwick University. I commenced data collection for this essay in the summer of 2016 and extended data collection procedures in February and June 2017. Akin to Essay Two, Essay Three involved a significant time period for data collection, intensive coding and analysis.

The thesis is concluded in section five. This conclusion reviews the major ideas and findings of the thesis and highlights general limitations and avenues for future research. While *specific* limitations and future lines of enquiry are included in each essay, the conclusion offers an opportunity to speak in generalities.

One final point is of note. As the forthcoming essays represent individual research projects, with alternative methods, they are different lengths and follow different structures.

## **2. ESSAY ONE - THIRTY YEARS OF ACQUIRING COMPANIES: A REVIEW OF THE WINNER'S CURSE IN BILATERAL BARGAINING**

### **2.1 Introduction**

In 1985 William Samuelson and Max Bazerman demonstrated that individuals routinely earn sub-standard or negative returns by failing to anticipate the decision rule of better-informed negotiators using the Acquiring a Company game (AAC)<sup>8</sup>. Their experiment tasked decision-makers with an intellectual puzzle, designed to illustrate the tension between the opportunity for mutual gain and the impact of asymmetric information. Theoretically, an information barrier brings a structural inefficiency to a bargain. Their application represented an explicit test of buyer rationality as assumed by Akerlof (1970) and signified an extension of the *winner's curse* to a new setting - bilateral bargaining. As previously identified in the context of common value auctions, this expression - the *winner's curse* - captures a behavioural outcome where individuals fail to account for an adverse selection problem embedded in success.

Since the original findings of Samuelson and Bazerman (1985) fifteen further studies have experimentally tested the *winner's curse* using the AAC game<sup>9</sup>. These studies are important as they examine whether individuals can formulate a bidding strategy that is consistent with the standard economic theory of negotiation. A typical treatment of naïve bidding strategies classifies suboptimal bidding behaviour as a disequilibrium phenomenon (Kagel & Levin, 2008).

Over a thirty-year period, a richer understanding of the curse in the domain of bilateral bargaining has emerged. The central finding is stark. Despite the presence

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<sup>8</sup> Occasionally this task is called the 'Takeover Task/Game' or the 'Acquisition Problem'.

<sup>9</sup> While several unpublished manuscripts testing the phenomenon do exist, this essay only considers the results from published studies.

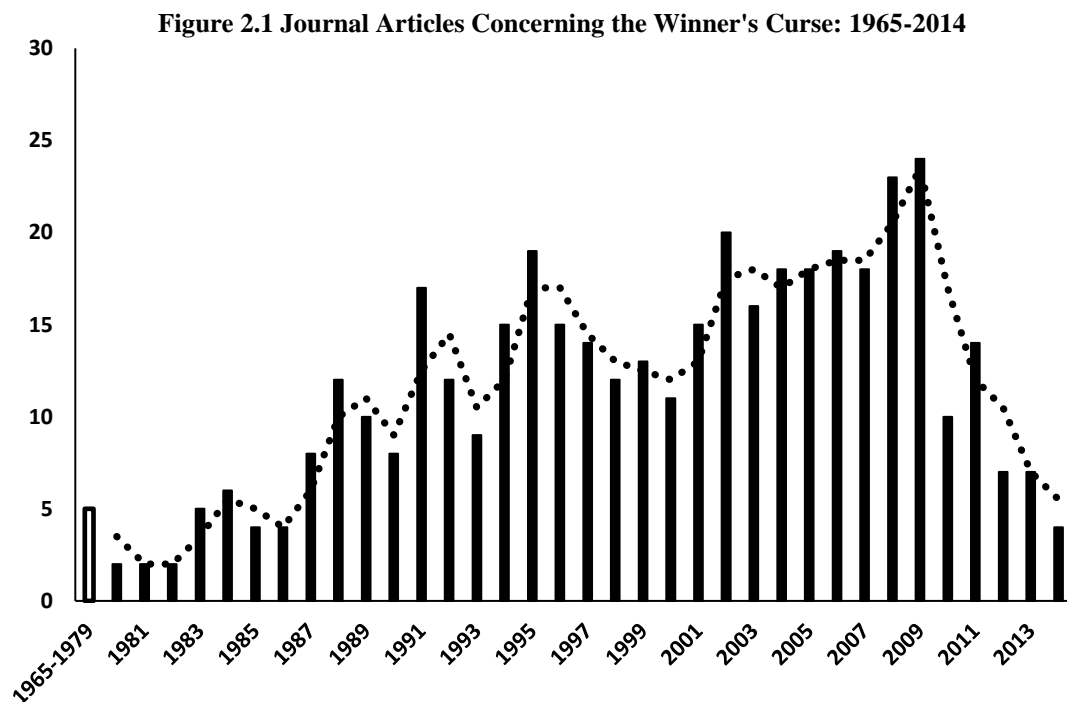


of asymmetric information, individuals regularly fail to foresee the perils of selective acceptance. Although a theoretical barrier exists to prevent mutually beneficial trades, decision makers often act as if information is symmetric. The repercussions of mistaking the decision rule of the seller results in consistently low and typically negative returns for negotiators, a propensity which naturally has a wholesale and practical application for organisations whom assumedly aim to negotiate rationally (Bazerman & Neale, 1992 chp.7).

The purpose of this essay is to review the experimental tests of the *winner's curse* in the setting of bilateral bargaining and synthesise prominent findings. A key contribution is to provide a current and precise assessment of the curse in this context, describing its robustness and explaining the direction of the research agenda. By tracing the development of this general projection bias, this essay can parallel other reviews of judgemental heuristics or rules of thumb which are important to the behavioural economics research agenda, all of which have been appraised after a significant period of research. These include the confirmation bias (Nickerson, 1998), framing on risky decisions (Kühberger, 1998), the hot-hand fallacy (after twenty years of research by Bar-Eli, Avugos, and Raab (2006)), the anchoring effect (after forty years of research by Furnham and Boo (2011)) and willingness to pay/accept gaps (after thirty years of research by Horowitz and McConnell (2002)). In particular, this essay can supplement literature on naïve bargaining by adding to the experimental survey of Kagel and Levin (2002) which focuses on the *winner's curse* in the context of common value auction experiments. As Figure 2.1 would suggest, the general topic of the *winner's curse* (in a variety of

domains) has become of increasing interest to researchers since the 1980's<sup>10</sup>. An increasing trend (and increasing moving average) is observed until 2009.

In addition, this study makes a contribution to the literature by conducting two small-scale experiments on the AAC problem from either side of the bargain. The first experiment provides insights to buyer psychology in the AAC task and questions whether 'cheap talk' or costly non-binding messages influence buyers. The second experiment probes seller rationality; the question of whether a seller can strategically avoid information is investigated.



<sup>10</sup> A database of the academic publications on the *winner's curse* is constructed via two online databases, *Google Scholar* and *Ebsco*. The data are collected between the 2<sup>nd</sup> and the 9<sup>th</sup> of November 2015. A total of 418 journal articles referred to the winner's curse. Unpublished manuscripts, working papers, newspaper articles and textbooks are not included. To warrant inclusion in the dataset, there must a specific reference to the concept and use of the term. The articles ranged from specific tests of the curse where complete studies consider its existence, to articles where the authors appeal to the *winner's curse* to explain their results or refer to the concept, even though their original research question is not essentially addressing the bias. 11.8 articles have appeared on average per annum over a 35-year period.

The next section of this work briefly recounts the history of the *winner's curse* and explains its evolution to the setting of bilateral bargaining. Section 2.3 illustrates the primary model developed to study the *winner's curse* in the domain of bilateral bargaining. Section 2.4 considers the results from studies that have adopted the core model while section 2.5 analyses the findings from extended experimental research on the AAC game in three specific domains: learning, communication and causal mechanisms. Section 2.6 specifies applications of the problem. Section 2.7 details experiment I concerning buyer behaviour and section 2.8 details experiment II concerning seller behaviour.

## **2.2 A Brief History of the Winner's Curse**

The *winner's curse* is the systematic tendency for individuals to overbid or follow naïve bidding strategies when the true value of an asset is unknown. The naming, and first explicit formal claim of the problem, was provided by three petroleum engineers in their influential study of bidding behaviour for oil and gas drilling rights in the Mexican gulf (Capen, Clapp & Campbell, 1971)<sup>11</sup>. The critical observation of Capen et al (1971) was that oil companies were cursed by overbidding for Outer Continental Shelf (OCS) leases during the 1960's. These companies suffered unexpectedly poor returns over the decade. This was a frequent event, often happening on a yearly basis. A causal factor, critical to the problem's occurrence, was that oil companies were ignoring the adverse selection problem inherent in winning an auction for oil rights, offering estimates for oil tracts based on

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<sup>11</sup> Antecedents of the problem do exist. The earliest insights, to my knowledge, can be traced to the PhD thesis of Donald H. Woods, under the supervision of Robert B. Wilson. Woods was the first to identify the central problem at hand for organisations (Woods, 1965).

unconditional expected values that did not adjust for tendering a successful bid. This finding was to have important implications for the research agenda.

Analysing overbidding in the aftermath of oil lease auctions continued to attract the lion's share of attention from researchers after the early contributions of Capen et al (e.g. Smith, 1982). However, the presence of alternative explanations and mixed evidence associated with field studies complicated the debate. Historically, the curse was a hotly disputed issue as observations of overbidding in naturally occurring markets encountered both data reliability problems and plausible alternative interpretations (Kagel & Levin, 2002). The motivation to conduct experimental studies on the *winner's curse* was a consequence of the ambiguity associated with naturally occurring markets contexts (e.g. Kagel & Levin, 1986). This led to the rise of a substantial experimental literature testing whether participants make systematic judgment errors when bidding in competitive environments under uncertainty. The obvious advantage of an experimental method was the reduced number of confounds associated with the approach and the greater degree of control over environmental characteristics that cannot be accessed while studying naïve bidding strategies in the field. Laboratory experiments offered a mechanism to control and vary the value of the item for sale, the information structure and the number of bidders. In sum, the experimental method provided a strictly controlled environment to test whether the curse was a robust phenomenon (Roth, 1995).

While the first mentions of the bias using experimental methods can be traced to Cox, Smith and Walker (1983), the first specific experimental test can be found in Bazerman and Samuleson (1983). The aptly named *I Won the Auction but Don't Want the Prize* was significant as it was the first published experiment to generally support the empirical findings of Capen et al (1971), albeit that the authors report

significant variation in the presence and magnitude of the effect. Since this 1983 article a wealth of experimental studies on the *winner's curse* in the original domain of common value auctions have emerged. A thorough review of this setting is documented by Kagel and Levin (2002).

The mid 1980's witnessed a different application of the problem. Samuelson and Bazerman (1985) extended the *winner's curse* to the new domain of bilateral bargaining. This study represented a migration of the concept from an experimental analysis of common value auctions to bargaining tasks. Although overbidding in the setting of bilateral bargaining has been referred to as "curse-like phenomena", given that the curse is recorded in a non-auction environment (Crawford & Iriberri, 2007 P.1722), the term is generally associated with both contexts. It is this branch of research, controlled bilateral negotiation experiments, which this essay concerns.

### **2.3 The Acquiring a Company Game & The Winner's Curse**

Seminal experimental work on bilateral bargaining under uncertainty was conducted in 1985 by William Samuelson and Max Bazerman<sup>12</sup>. The model they developed falls into a general class of situations characterised by adverse selection. This was a problem identified by Akerlof (1970). Importantly, Akerlof recognised that asymmetric information has the potential to destroy the attractive properties of welfare enhancing trades. Consequently, information differences can be a source of market failure.

The initial study developed and experimentally tested three versions of the AAC game where a buyer and seller negotiate over the sale of a company of unknown value to the buyer. The three versions of the game have alternative parametric

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<sup>12</sup> Prior theoretical work important to this experimental exploration is detailed in Samuelson (1984).

structures which determine the asset's value. For each bargaining model a normative negotiation solution exists for a buyer who has access to less information. Equally, given the information structure, normative decision rules exist for sellers. The first version considers a bargain where the outcome is dependent on a discrete probability distribution. The second considers a bargain where the outcome is dependent on a uniform probability distribution when a fixed absolute advantage exists for the buyer upon the completion of a trade. A benefit to the buyer from achieving a trade is constant for all values of the asset in this second structure.

The third parametric structure considers a bargain where the outcome is also dependent on a uniform probability distribution where gains from trade are proportional to the value of the asset. This third model has a beta distribution which assumes a prior value of 1 for both  $\alpha$  and  $\beta$ . This standard (generalised) beta distribution reveals a smooth probability distribution and offers a versatile means to define prior knowledge. This is attractive for methodological purposes. Given that the distribution is defined between 0 and 1 it provides a useful tool to deal with probabilistic decision making. It is the third version of the AAC game that is of greatest interest and has inspired significant further study. A stylised example of this model is provided here. The prediction of this model is that asymmetric information is a barrier to mutually efficient transactions<sup>13</sup>. The parametric structure provides an illustration of extreme adverse selection as a rational analysis reveals that a negotiator's best strategy is to refrain from entering a bargain given the information

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<sup>13</sup> It should be noted that imperfections in the information structure is not the only reason why negotiators do not reach a positive contract zone; a psychological explanation for the existence of impasses in bargaining is the self-serving bias (Babcock & Loewenstein, 1997).

structure. While reaching this conclusion is intuitively demanding, it is relatively straightforward analytically.

### **2.3.1 The Standard Bargaining Model - An Illustrative Example**

From the outset, it is assumed that the true value of an asset is unknown to a buyer who only holds probabilistic information regarding the true value. The model had a uniform probability distribution of possible values for an asset within a jointly known distribution. While the value of the asset to both parties will vary depending on the random distribution, regardless of the value, the asset is worth at least as much to the buyer as it is to the seller. Typically, the multiplier is 50%. The seller is aware of the true value. As an accepted bid would occur on a selective basis by a rational seller (full information player), valuable information is embedded in a bargain being struck. A rational examination of the problem reveals that the existence of an information asymmetry is a barrier to a mutually beneficial trade.

Assume that:

$X_v$  = the true value of an asset which is known to the seller but unknown to the buyer. The value of this asset is uniformly distributed between the values £0 and £10,000, allowing any one of eleven potential integers ( $v \in [\text{£}0, \text{£}10,000]$ ) equally likely to take on the true value

$X_b$  = the true value of the asset to the buyer. Assume that  $X_b$  is greater to the buyer than to the seller. To begin, and for illustrative simplicity, assume that the asset is worth 50% more to the buyer ex-post. Thus,  $X_v = 1.5 * X_b$

$B_1$  = A buyer's uncertain estimate

$S_a$  = A seller's acceptance of a buyer's uncertain estimate

$R$  = the net returns (profit/loss) for a buyer from any *accepted* bid by a seller

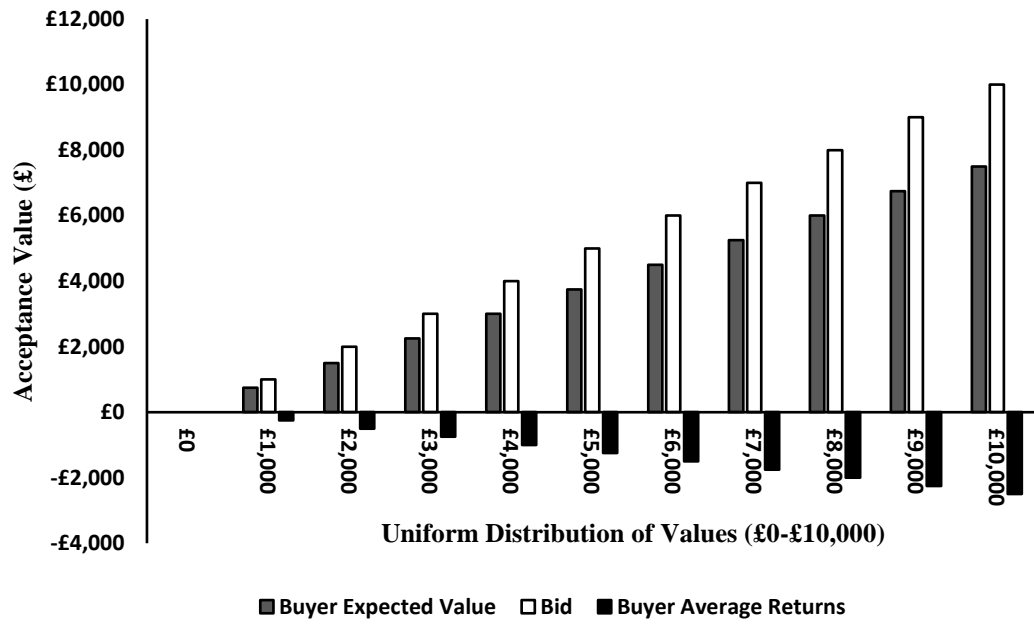
To understand the average value of  $X_b$ , one imposes a decision rule so that  $S_a$  only occurs when  $B_1 \geq X_v$ . If  $B_1 < X_v$  impasse follows. When  $B_1 \geq X_v$  then  $R = X_b - B_1$ . This derives from the principle of selective acceptance. Specifically, any rational seller *will not sell an asset for less than its true (known) value*. On acceptance, the expected value of the asset can occur over a range of uniformly distributed values from  $\pounds 0 \leq X_v$  but not for any value  $> X_v$ . For any *accepted* bid the expected value of the asset is  $(0.5 * B_1) * 1.5$ . Thus, on  $S_a$ ,  $R = (0.5 * B_1) * 1.5 - B_1$ .

The *combination* of the seller's decision rule and the uniform probability distribution ensures that irrespective of the presence of a positive bargaining zone, on average, buyers secure assets which are worth 25% less than the true value. Incorporating this pay-off structure and probability distribution, the likely losses emerging from positive bids will range on average from - $\pounds 250$  to - $\pounds 2,500$ . The optimal bidding strategy for any rational buyer is to offer  $\pounds 0$ . This strategy is identical to abstaining from the trade.

When tested experimentally this model exhibits sequential moves. A definitive offer by the buyer (move one) is followed by a seller's acceptance or rejection (move two). Following the seller's acceptance or rejection decision the game concludes. For example, if an uncertain estimate of  $\pounds 5,000$  is accepted by the seller, the expected value of the asset is less than the original bid  $((0.5 * \pounds 5,000) * 1.5 < \pounds 5,000)$ , so that  $R = -\pounds 1,250$ . For this *accepted bid* of  $\pounds 5,000$  there is a two thirds likelihood that the buyer will experience net negative returns (true value  $\pounds 0$  to  $\pounds 3,000$ ) and a one third likelihood that an accepted bid will lead to net positive returns (true value  $\pounds 4,000$  or  $\pounds 5,000$ ).



Figure 2.2 Average Values (£) Conditional on Seller Acceptance

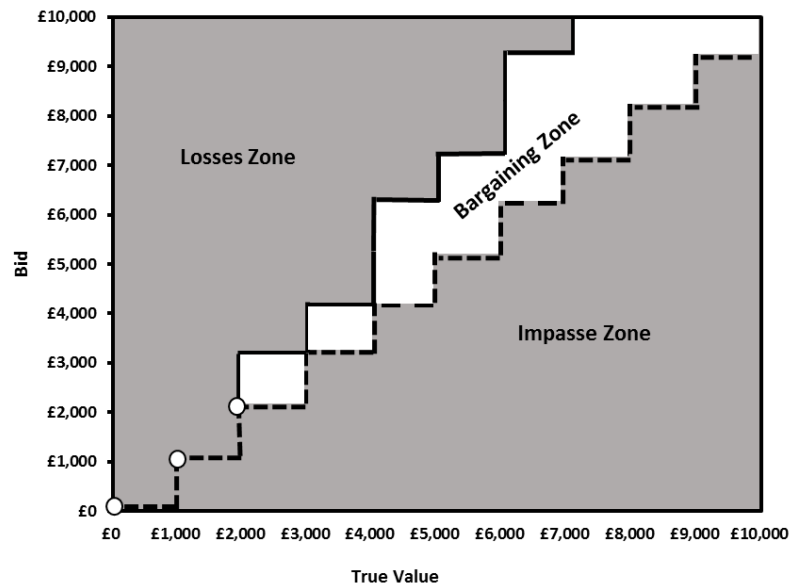


In light of the decision rules introduced, where  $S_a$  only occurs when  $B_1 \geq X_v$ , a normative strategy is that a buyer should refrain from making a bid. Thus, the model provides a point prediction. Given the parametric structure of the problem, rational decision makers should reason to the equilibrium bid of £0. Falling prey to the curse involves a bidder adopting a naïve bargaining strategy, failing to appreciate the asymmetry in information.

One hundred and twenty-one possible permutations of the model exist that are contingent on the random true value *and* subsequent buyer estimate. To visualise the bargaining model, Figure 2.3 provides an illustration of the three potential bargaining outcomes for alternative bidding strategies a buyer may take. This figure depicts the structural inefficiency that is built into the AAC game as a positive bargaining zone exists (Bazerman & Moore, 2009 P.55). Of the one hundred and twenty-one possible permutations of the negotiation that exist, fifty-five states (45%) of impasse are possible; this is an outcome where the offer made by a buyer is below

the true value of the asset and is rejected given the seller's decision rule. Twenty-six possible states (21%) exist where a bargain can be struck. In this zone the buyer does not incur negative returns and a sale is completed for the seller. These states are indicated by the points and zone marked in white in Figure 3.3. Twenty-two states (18%) in this bargaining zone result in positive (non-neutral) profits to the buyer. For the first three bidding strategies (£0 – optimal bid, £1,000 and £2,000) only one possible value allows the buyer to strike a bargain that produces non-negative returns. The remaining forty possible states (34%) result in losses to the buyer.

**Figure 2.3 Bargaining Zones Contingent on AAC Outcome**



Naïve positive bidding under this parametric structure persists until the multiplier doubles. Once the value of the asset is twice the worth to the buyer than it is to the seller, the average value of *all* accepted bids becomes neutral. Consequently, the optimal bidding strategy switches from refraining to enter the trade to bidding the highest possible offer when the gains from trade are greater than double the true value. As is later highlighted, the tightening of the lower bounds of the parameters also modifies the optimal bidding strategy.

## 2.4 Bidding Results from the Uniform Distribution Bargaining Model

The initial laboratory analysis of the model outlined in the previous section tested for naïve bidding behaviour amongst 595 MBA students at Boston University.

Participants were provided with a narrative about acquiring a company and were tasked with submitting a bid<sup>14</sup>. This served to contextualise the adverse selection problem.

The central finding of this seminal study is that buyers consistently fail to follow a normative bargaining strategy. In this extreme adverse selection setting, where participants should refrain from entering negotiations, Samuelson and Bazerman (1985) show that buyers fail to anticipate the behaviour of the better-informed seller, who would not sell their company for less than it is worth. In all three variations of the bargaining game, participants overwhelmingly choose to bid round numbers and 93% of participants rejected the normative bidding strategy (\$0)<sup>15</sup>. Figure 2.4 reproduces count data showing the number of bidders that fall within a bidding range from the original Samuelson and Bazerman (1985) experiment<sup>16</sup>. Only 7.5% and 7.7% of the samples could reason to the normative strategy in the non-incentivised and incentivised version of the experiment.

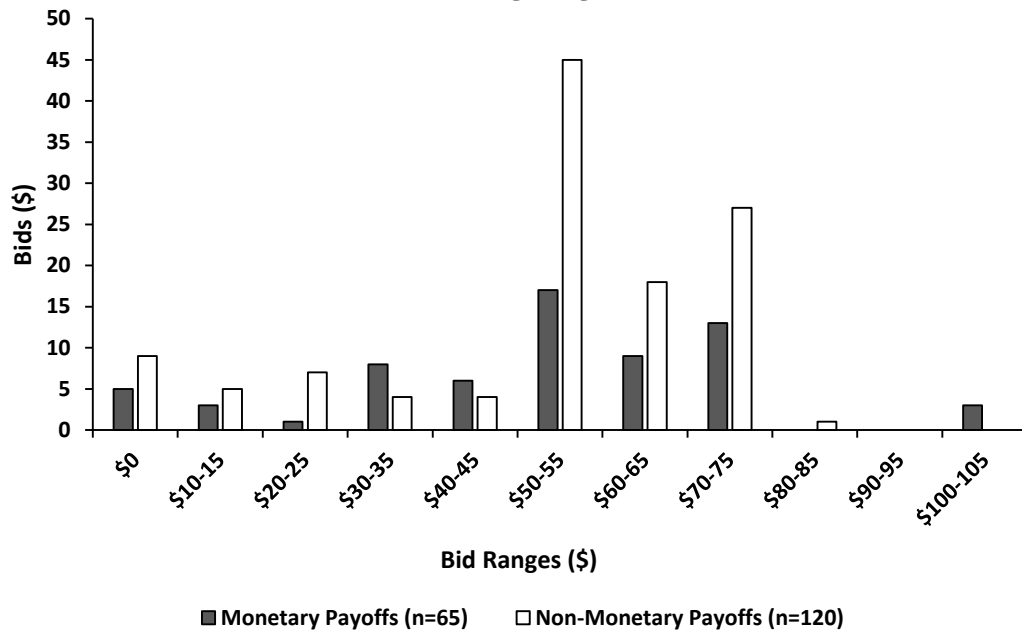
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<sup>14</sup> The original instructions are replicated in the appendix.

<sup>15</sup> In version 1 (two possible values) of the model 41% of participants bid optimally. Only 16% and 7.5% bid optimally in in the more complex version two (lower limit) and version three (unknown value with a uniform distribution) of the experiment.

<sup>16</sup> Note, different values are used in my description compared to the original values used.

**Figure 2.4 Samuelson & Bazerman (1985) - Version 3: No Bidders by Bidding Range**



As Samuelson and Bazerman (1985) initially identified, reasoning to the normative outcome rarely occurs. Table 2.1 reports the mean offers and the percentage of the sample that bid optimally from experiments that adopt version three of the original Samuelson and Bazerman (1985) negotiation model described above. This table synthesises the evidence from different studies that adopt the original model and report reasonably specific estimates. This provides a comparable metric to consider the existence of the curse in this setting and a means to consider the ability of further studies to replicate the original findings.

**Table 2.1 Bidding Results – Uniform Distribution Bargaining Model**

<b>Authors</b>	<b>N</b>	<b>Mean Offer (% of Sample)</b>	<b>Optimal Bids</b>
Samuelson and Bazerman (1985)	120	50-75 (75%)	7.5%
Carroll et al (1988)	75	50-75 (52%)	10.6%
Ball et al (1991)	69	52.61	7.2%
Foreman & Murnighan (1996)	8	~49-52†	0.0%
Tor & Bazerman (2003)	82	65.84	8.5%
Idson et al (2004)	51	-	13.7%*
Selten et al (2005)	-	~40†	-
Grosskopf et al (2007)	20	38.84*	-
Garbarino & Slonim (2007)	62	50-75 (69%)	6.5%
Bereby-Meyer & Grosskopf (2008)	21	~45-55*†	0.0%

\* A control treatment

† Inferred from graphical representation

Either exact or partial information for the variables of interest in Table 2.1 are reported for ten of the fifteen studies that test the standard AAC model. The original studies of the problem reveal that participants commonly bid close to the unconditional expected value of the asset, with few participants bidding optimally. For studies that report the distribution of bids, the modal bid range is typically from .50 to .75 of the asset's value. All of the experiments that adopt a uniform distribution bargaining model, where an equilibrium bid is zero and report mean bidding data, on average, observe non-optimal buyer behaviour. Each of the ten studies in Table 2.1 reveal that optimal decision-making is infrequent. For two studies, no participants in the sample tender an optimal bid. Unpublished experiments have also reported bidding data similar to the published studies above<sup>17</sup>.

Three years after the formation of the AAC game, Carroll, Bazerman and Maury (1988) exposed the resilience of the curse, producing similar experimental evidence

<sup>17</sup> Daniel Kahneman and Richard Thaler found that twenty out of twenty-four participants from faculty and doctoral student made naïve bids. The two that failed to bid admitted that they had done so due to cowardice (Thaler, 1994 P.161).

to the initial study. This was followed by the first experiment of Ball, Bazerman and Carroll (1991) who observed consistency in terms of bidding strategies with the first two studies. For Ball et al (1991), the mean bid across twenty trials had a minimum value 45.37 and a maximum value of 58.61 (on the first round trial). Six further studies have reported relatively consistent average bidding strategies with the first three studies of the puzzle. An average bid of 38.84 is the lowest recorded average bid to date (Grosskopf, Bereby-Meyer & Bazerman, 2007).

## **2.5 Experimental Extensions & Exploring the Winner's Curse**

The uniform probability distribution bargaining model is essential as it provided a theoretical and methodological basis for fourteen further articles. These advances have incorporated incremental extensions or adjustments to the task to increase the complexity of the model. Table 2.2 provides an overview of the tests which implement the AAC model in chronological order<sup>18</sup>. The extension is identified which explains the methodological development and/or the new hypothesis tested.

The purpose of this section is to classify the motivations for these further works under alternative streams and to summarise the major findings in each domain.

Research on the AAC game has branched in three directions. For conciseness, three questions have been chiefly posed in light of the naïve bidding strategies originally observed.

1. Is the *winner's curse* robust to learning?
2. What are the effects of communication in the AAC game?
3. What are the psychological mechanisms causing decision making errors?

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<sup>18</sup> Significant alternations to the basic game, such as Keysar, Ginzel & Bazerman, (1995) which are used to test related hypotheses (such as the curse of knowledge) are not included in the table below.

**Table 2.2 The Acquiring a Company Game: 1985-2015**

Author(s)	Year	Experimental Extension(s)
Samuelson and Bazerman	1985	The original AAC experiment. Three alternative parametric structures are adopted.
Carroll et al	1988	Participants are recorded thinking aloud while participating in the AAC game to conduct verbal protocol analysis.
Ball et al	1991	Roles of buyers and sellers are iterated to facilitate learning and perspective taking.
Holt & Sherman	1994	Alteration to the parametric structure to test for naïve underbidding or a ‘loser’s curse’.
Foreman & Murnighan	1996	Observational opportunities (seeing others losses) and experiential learning opportunities are provided (4 week time gaps to allow reflection between trials).
Valley et al	1998	Alternative mediums of costless non-binding pre-play communication (cheap talk) are added to face-to-face, over the phone and in writing to AAC bargains.
Bazerman	2002	The AAC game is tested with skilled individuals from the financial services industry (reported in Tor & Bazerman, 2003).
Tor & Bazerman	2003	Participants are recorded thinking aloud to conduct verbal protocol analysis across multiple decision problems.
Idson et al	2004	Participants are provided with training. This involves undertaking the Monty Hall problem and a multi-party ultimatum game task <i>before</i> taking the AAC puzzle.
Selten et al	2005	The AAC game is tested over longer experimental periods to Ball et al’s (1991) 20 round experiment and the lower bounds of models parameters are increased.
Grosskopf et al	2007	A tweaked design that changes the added value of the company to the buyer and allows participants compare and contrast valuations. In a second experiment information is added to show participants forgone payoffs.
Garbarino & Slonim	2007	A ceiling effect is estimated over twenty bidding rounds where participants firstly partake in the AAC game and then have to accept or reject lotteries that reflect identical probabilities to positive bids in the game.
Bereby-Meyer & Grosskopf	2008	The payoff variance is decreased. To control for any potential experimenter demand effects, participants are offered an opt-out choice before bargaining commences. To control for participants experiencing a thrill from gambling the structure of the game is simplified.
Charness & Levin	2009	A transformation of the AAC into an individual choice problem showing participants one hundred cards.
Casari et al	2015	The AAC game is tested on groups as opposed to individuals. Traditional equilibrium bids (\$0, \$50, \$100) are not adopted. Only a discrete and small range of true values are used.
Di Cagno et al	2015	Cheap talk is introduced to the AAC game to test whether there are gender differences in strategic behaviour.

### 2.5.1 Learning

The persistence of the curse has been investigated by testing whether learning or experience diminishes the frequency of the bias. Central to this branch of experimental work is a commitment to address the issues of feedback and practise. A standard perspective regards disequilibrium bidding strategies, and subsequently loss-making outcomes, as transient. In the case of the AAC model, this constitutes the adoption of naive bidding strategies in the form of positive offers on behalf of the buyer. Traditional economic theory would maintain that participant behaviour adjusts toward equilibrium responses through learning. In turn non-equilibrium strategies will be replaced by more efficient ones (Samuelson, 2005). While the curse was present in one shot tasks, is disequilibrium bidding behaviour corrected over time? Do participants learn the opponent's decision rules or become more experienced after multiple iterations of the task?

In contrast to the common value auction setting where learning can occur to a greater degree, several studies have shown that a significant adjustment to the normative bidding strategy does not occur for the AAC game. The initial evaluation of learning was conducted by Ball et al (1991). In their first experiment that took place over 20 trials, only 5% of the sample displayed traits of learning, signifying that their bidding strategy advanced to an equilibrium bid. The second experiment of Ball et al (1991) adopted a role reversal treatment to question if participants learned when they are exposed to the perspective of the alternative party in the trade. The researchers elicit data that did not differ significantly from their first experiment; only 4 out of 44 participants learned the optimal bidding strategy from playing the task of the counterpart in the trade.



The similarity in results between the initial one-shot experiments and repeated trials found by Ball et al (1991) was confirmed by Foreman and Murnighan (1996). In their study Foreman and Murnighan (1996) tested the AAC problem twice a week over a four-week period. The participants were encouraged to reflect on their strategies between bidding sessions and had the opportunity to observe other individual's decision making strategies. Suggestively, individuals observed fellow participant's cursed bids. Using the standard model outlined in the previous section, Foreman and Murnighan (1996) show that reflection periods and considerably more information minimally reduces the frequency of naïve bidding strategies. Comparing offers, the highest bids were consistently observed in the AAC puzzle vis-à-vis common value auctions experiments. The authors conclude that avoiding the curse is difficult and rare, concluding that "people appear to be tremendously susceptible to the *winner's curse*. Neither information, experience, time, a variation in endowments, nor a problem that allowed the possibility of profitable bids helped them learn to avoid the curse. It was extremely persistent" (Foreman & Murnighan, 1996 P.178).

More recent evidence contends that the *winner's curse* is robust to stronger learning techniques. The inability of subjects to learn to avoid the curse has been attributed to the inherent variability in the feedback. In the standard model, alternative probabilities of making a profit exist if a bid is accepted. Adopting the bidding strategy of offering the unconditional expected value (£5,000) of the asset gives the buyer a one-third chance of ensuring a positive return and a two thirds likelihood of incurring a loss if a bid is accepted. This variability in the likelihood of the gamble is

not constant however and differs for every accepted bid under the uniform distribution model<sup>19</sup>.

Researchers have attempted to alter this feedback mechanism as a primary concern with Ball et al (1991) is the distinctiveness of the normative solution, as viewed in the stylised bargaining model. In response to this concern, harder learning techniques have been sought out. A potential solution has been to alter the variability of feedback participants are provided so that the probability of winning is substantially reduced. Logically this increases the likelihood of losses (Grosskopf, Bereby-Meyer & Bazerman, 2007). Despite this alteration, participants fail to climb the learning curve. Overbidding remains even when the optimal response is positive (which is achieved through altering the lower bounds of the value of a seller's asset) and one hundred trials are adopted in contrast to the 20 trials run by Ball et al (1991) (Selten, Abbink & Cox, 2005).

Idson, Chugh, Bereby-Meyer, Moran, Grosskopf and Bazerman (2004) argue that training, as opposed to procedures to facilitate learning, can improve decision making in this task. Idson et al (2004) show that training can soften the bias. Training for participants constituted partaking in other common puzzles such as the Monty Hall problem prior to bidding in the AAC task. While 13.7% of the participants in the control treatment followed the normative strategy, 32.6% and 38.8% of participants in training treatments reach the solution of abstaining from trade. More systematic training, as opposed to placing confidence in the

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<sup>19</sup> Ignoring the probability of acceptance, this positive return likelihood has a lower bound of odds of one-quarter. This occurs when a bid of £3,000 is accepted. The variability can increase to a maximum of a one-half likelihood of success when a £1,000 bid is accepted.

participant's ability to learn after the iteration of roles or receiving detailed feedback acts as a more successful mechanism to debias the problem.

The most recent effort to challenge the persistence of the curse has questioned if groups can learn optimal bidding strategies or behave in a more strategically sophisticated manner than individuals (Casari, Zhang & Jackson, 2015). The Casari et al (2015) study contrasts the performance of individual and group bidding behaviour in the AAC game. Three member groups outperformed individuals in the fraction of cursed winning bids. The percentage of bids with negative expected profits for individuals was 18.3%, however it was 10.5% for groups. Groups were also recorded as showing a significant improvement over the course of the experiment. This learning was in contrast to the individual treatment where no significant improvement was observed.

### **2.5.2 Communication**

The dynamics of naïve bidding have been explored by adding pre-play communication to the AAC task. Specifically, researchers have asked whether the efficiency of a negotiation is altered by cheap talk and by alternative communication media.

In the first experiment to scrutinise communication effects using this model, Valley et al (1998) compared negotiated outcomes when participants communicated face-to-face, by phone, and in writing. MBA students were recruited and grouped into 83 negotiation pairs for alternative communication treatments (46 for a written treatment and 37 in a face-to-face treatment). Valley et al (1998) find that these costless nonbinding signals (messages) aid the formation of mutually beneficial trades. Logically, the content of these messages should have no influence on the

underlying incentive structure faced by participants and should not alter the normative bidding strategy. The incidence of the *winner's curse* remained constant across communication mediums but, critically, the medium in which cheap talk occurred affected the outcome of the negotiation process. Efficient outcomes are commonly reached in face-to-face negotiations with the use of cheap talk. Impasse only occurred twice in the face-to-face cheap talk treatment. Although all modes of communication increased the efficiency of trades over the standard prediction of impasse, surpluses were more evenly distributed in face-to-face trades. As the authors suggest, “honestly may be endogenous to the negotiation process” (Valley et al, 1998 P.233).

Although the model's prediction would not differ according to the level of sociality involved in a trade, the asocial contact involved in the ACC game appears to be a primary impediment to achieving welfare enhancing trades. Valley et al (1998) find that the medium in which cheap talk occurred, face-to-face, by phone, and in writing, affected the outcome of bargaining and impasse only occurred twice in the face-to-face cheap talk condition. The results suggest that social interactions provide negotiators a vehicle to overcome the inefficient outcomes of the theoretical prediction of impasse.

Most recently, Di Cagno, Galliera, Güth, Pace and Panaccione (2015) analysed the effects of gender when pre-play communication is allowed in the AAC game. Their modification of the AAC game restricted knowledge of the other negotiator's gender for various treatments. A primary finding from the investigation of gender effects with cheap talk is that female sellers, aware that they are participating with a female buyer, show a tendency to overstate the value of their asset.

### 2.5.3 Causal Mechanisms

Thirdly, underlying psychological processes have attracted the attention of researchers. Competing explanations to explain the source of the *winner's curse* in private negotiations exist. These fit into two broad categories; (i) information disadvantages/deficits and focussing failures and (ii) risk preferences. Explanations within these general categories appeal to alternative psychological processes.

#### 2.5.3.1 Bounded Awareness

The primary and standard mechanism to explain the curse suggests that individuals can systematically fail to appreciate their information disadvantage or fail to adjust their estimations in light of other's information. The standard account stresses the importance of an information asymmetry in creating the cognitive illusion, leading to a general propensity labelled as bounded awareness (Bazerman & Chugh, 2006).

This occurs when individuals fail to perceive and use information that is important to making an optimal decision (Bazerman & Tenbrunsel, 2011). Bidders can make the mistake of assuming symmetric information or fail to understand the information expressed in accepted or winning bids. Under this reasoning, decision makers are blind to the importance of the actions of others when focusing on a competitive task. Negotiators limit their focus of attention on personal goals and ignore contingencies that are as consequence of the private information possessed by others (Samuelson & Bazerman, 1985; Carroll et al, 1988; Tor & Bazerman, 2003). This specific single-mindedness can ultimately lead to negotiator overconfidence (Neale & Bazerman, 1983). This set of explanations views the intrinsic naivety or bounded rationality of an individual, who has failed to either realise either the impact of asymmetric information or has failed to foresee the fact that future decisions are relevant for

current ones, as the most important causal factor underlying the curse (Charness & Levin, 2009).

Verbal protocol analysis has provided a useful qualitative instrument to analyse this hypothesis in an experimental setting. By asking participants to think out loud during the game, researchers have identified why information deficits are formed (Carroll, et al, 1988; Tor & Bazerman, 2003). A primary explanation emerging from verbal protocol analysis of participant behaviour suggests that negotiators simplify the task or the cognition of the other negotiator. This simplification process can cause an illusion of equal information. As Carroll et al (1988 P.21/22) surmise “when individuals are faced with contingencies, they make simplifying assumptions to make decision making under uncertainty more manageable”. The combination of negotiating with another and the requirement to understand future contingencies fosters an extremely challenging bargaining framework for normative bidding behaviour to take place.

### **2.5.3.2 Risk Preferences**

The second economic and psychological factor scholars have probed to explain the origins of the *winner's curse* is risk preferences. Research relating to risk aversion propensities has asked whether bidders experience gratification from “the thrill of winning”? (Holt & Sherman, 1994 P.642). Under this explanation, gratification from success is deemed a significant factor in causing the curse. Holt and Sherman (1994) establish parameters in the AAC model where the naïve strategy for a buyer is to underbid – a type of bidding behaviour labelled the Loser's Curse. If the *winner's curse* can be explained through a thrill associated with winning (rather than failing to appreciate the seller's acceptance rule), then it follows that underbidding should not

occur or that its frequency should arise to a lesser degree to that of a *winner's curse* treatment. To test this hypothesis Holt and Sherman (1994) tightened the parameters of the standard model so that the lower bound of the seller's asset ranged from 0.5 to 1 for one (loser's curse) treatment. Consequently, positive offers were in the buyer's interest. The primary finding of Holt and Sherman (1994) is that the bidding strategies of participants, regardless of the parameters (*loser's/winner's curse*), are similar. The study finds no strong evidence exists for the utility/thrill of winning hypothesis as an explanation for the *winner's curse*.

Garbarino and Slonim (2007) consider risk preferences further and present experimental data that supports their hypothesis that a proportion of individuals prefer at least one or more of the underlying lotteries attributed to positive bids in the AAC game. According to the authors an underlying psychological explanation for the presence of decision errors, in this context positive offers in the AAC game, is the preference for positive bids on behalf of buyers. The researchers observe consistency regarding participants' bids and their subsequent acceptance/rejection decision when offered lotteries that reflect identical probabilities to those underlying positive bids in the AAC game. As opposed to a decision error as a plausible psychological reason to explain naïve bidding strategies in the game, non-monetary utilities that are embedded in participant preferences (such as participation, or actively engaging in an alternatively framed tasks), may offer an incentive to bid.

## 2.6 Applications

The implication of failing to account for the decision rule of a seller, and subsequently overbidding, has a variety of practical implications. In particular, these insights are applied to organisations undertaking mergers and takeovers bids (Bazerman & Moore, 2009). The curse is categorised as a ‘common mistake in negotiation’ as managers fail to account for the valuable information held by an interacting party (Bazerman & Neale, 1992). Cognisance of a seller’s decision rule can allow organisations to pre-empt the dangers of selective acceptance rather than suffering from after-the-fact regret. Roll (1986) originally discussed the curse in the context of corporate takeovers where buying firms return little or no gains. By collecting data on stock prices upon the announcement of takeover bids, Roll (1986) inferred that acquiring firms make low levels of profits (less than expectations) upon acquisition.

Along with other psychological biases such as intentional blindness, the psychological factors underpinning the curse have more recently been applied to the field of behavioural ethics. The concept of ‘bounded ethicality’ highlights how failing to notice information imperfections can cause individuals to behave in a manner that is inconsistent with one preferred ethics (Bazerman & Sezer, 2016). Equally, one’s failure to observe important information to decision making can lead to a failure to observe or prevent other’s unethical acts (Chugh & Bazerman, 2007; Bazerman & Tenbrunsel, 2011).

A variety of interesting empirical studies have applied the idea to sports labour markets, given the wealth of data available in this domain. Very often sports labour markets represent high stakes environments where repeated behaviours occur. For



instance, Cassing and Douglas (1980) considered competitive bidding upon the removal of the reserve clause in major league baseball, showing that majority of free agents signed in the late 1970's bore negative productivity returns and were paid 20% more than their projected marginal revenue product. More recently, the strength of this finding has been revaluated in light of improved measures of productivity. The evidence still points to a weak-form of the curse existing in the field as potential buyers fail to take all past information into account (Burger & Walters, 2008). Assessing American Football, Massey and Thaler (2013) found evidence that outcomes from the National Football League draft are consistent with research on the *winner's curse*.

## **2.7 Experiment I: Insights to Buyer Psychology in Bilateral Bargaining**

### **2.7.1 Background & Key Findings**

Valley et al (1998) find that cheap talk or costless nonbinding signals (messages) help bargainers. Rather than using cheap talk to deceive another negotiator, they show that bargainers use communication as a mechanism to establish gains from trade, despite the fact that economic theory would predict impasse (Akerlof, 1970). Although cheap talk is not a panacea to securing Pareto-efficient outcomes, messages sent by sellers who have private information can modify a buyer's assessment of a seller's trustworthiness (Farrell & Rabin, 1996). Cheap talk can support efficient trades and diminish the frequency of the *winner's curse*. It is particularly relevant if it aids two parties in avoiding communication problems (Charness, 2000). This is interesting as buyers should not be influenced by cheap talk in a bilateral bargain. Treating it as meaningless is consistent with rationality. Despite its costless nature, cheap talk is still recognised as "an integral part of bargaining" (Croson, Boles & Murnighan, 2003 P.144).

Here, I question whether cheap talk can have subtle psychological effects using the AAC bargaining model. More accurately, I hypothesise that appearing perfect or ‘too good to be true’ when bargaining can cause one to be trusted less. While Valley et al (1998) were primarily concerned with the medium through which cheap talk was conveyed, I explore whether a message affects interpersonal attractiveness and trust. Assuming that a bid reflects the buyer’s suspicion/trust, this experiment explores whether heterogeneous cheap talk measures influence a buyer’s strategic behaviour. In doing so, the aim is to provide an improved description of the role of cheap talk in bargaining scenarios, a setting where communication is commonplace.

The experimental design adopted follows Valley et al (1998) and Di Cagno et al (2015) - a cheap talk game with asymmetric information. Essentially, the experiment mimics a signalling game with one sided, costless, pre-play communication. The design is based on an adaption of Samuelson and Bazerman’s (1985) original AAC game. Identical parametric structures to the experimental work of Samuelson and Bazerman (1985) and later Ball et al (1991) are applied. This design is used to enquire whether heterogeneous cheap talk modifies the trust levels of uninformed buyers.

This study is motivated by the need to consider the effects of specific communication strategies in negotiating scenarios characterised by asymmetric information and misaligned incentives. As suggested, the aim is to provide an improved description of the dynamics of cheap talk using the AAC negotiation model. To date, the literature concerning the effects of communication in the AAC model is relatively underdeveloped. Specifically, there is an absence of research concerning the nature of specific communication strategies and its influence on bidding behaviour and trade. Such research can have practical significance given the

prevalence of tacit bargaining that involves communication in the context of trade agreements or labour relations (Crawford, 1990; Lewis, 2011).

Given that cheap talk can convey meaning where there is a moderate (but not overwhelming) incentive to lie, I hypothesise that appearing imperfect to a point increases the trust of an uninformed buyer. Conversely, this suggests that when buyers only have partial information, appearing perfect as a seller will diminish a buyer's trust/increase a buyer's suspicion. This hypothesis is derived from social psychology. The advantages of making purposeful errors has shown that to err can increase one's interpersonal attractiveness or 'believability' (Aronson & Linder, 1965; Aronson, Willerman & Floyd, 1966). This psychological insight has been applied in a commercial context (Ein-Gar, Shiv & Tormala, 2012), to intrapersonal relationships (Miron, Knepfel & Parkinson, 2009) and to education (Uranowitz & Doyle, 1978). Occasionally, appearing imperfect occurs naturally.<sup>20</sup>

I extend this insight to bargaining. By addressing subtle psychological tendencies, one can gain a richer description of bargaining behaviour and add to the 'rebirth' of social psychological insight to the study of negotiation (Bazerman, Curhan, & Moore, 2001 P.199).

Unsurprisingly, the study finds that only a small percentage of the sample (4.27%) play equilibrium bids. This is consistent with the extent of optimal bids previously recorded (seen in Table 2.1). As measured by the difference between the claimed value (cheap talk) and mean bid, the highest level of distrust is observed when sellers allege that their asset is the highest possible quality (flawless). A high level of

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<sup>20</sup> For example, when Mount Everest was first measured by Radhanath Sikdar, a mathematician and surveyor, the recorded height was exactly 29,000ft (8,839m). Publically, an additional 2ft were added to the height to increase the trustworthiness of the measurement process.

receiver scepticism exists across all cheap talk treatments. The level of scepticism decreases as sellers claim to have lower value assets. Despite the fact that the numerical results reflect the underlying hypothesis, inferential statistical tests suggest that no significant differences are present in bidding behaviour across cheap talk treatments.

The next section briefly introduces related experimental literature that spans economics and behavioural decision research that are specific to this research question but outside central literature previously considered for the AAC game. Section 2.7.3 briefly recaps on the bargaining model, explaining any minor alternations required to facilitate testing the hypothesis. Section 2.7.4 considers matters relating to the task, design and procedures. Section 2.7.5 provides details on the participants. Section 2.7.6 outlines the results. Section 2.7.7 concludes the experiment with a brief discussion.

### **2.7.2 Related Literature**

It is important to note that the effects of pre-play communication have been studied through alternative bargaining games outside the AAC model. For instance, Croson et al (2003) show that both proposers and responders in the ultimatum game lied equally often and that these lies were more likely to come earlier in a bargaining game. Cheap talk influenced bargaining more than theoretically expected as lies about private information and non-credible threats altered both short and long-term bargaining outcomes.

Other previous investigations into the role of pre-play interaction outside of bargaining games has shown that communication can solve coordination problems in the battle of the sexes game (Cooper, DeJong, Forsythe & Ross, 1989) but has little

effect in trust games (Bracht, & Feltovich, 2009). Charness and Grosskopf (2004) add cheap talk treatments to a version of the stag hunt game and show how pre-play communication facilitates coordination. Finally, Palfrey and Rosenthal (1991) show that participants are significantly affected by a cheap talk message in public good games. Crawford (1998) provides an overview of a variety of experiments which adopt cheap talk.

### **2.7.3 The Bargaining Model**

To explore the dynamics of cheap talk I utilise the AAC bilateral negotiation game with asymmetric information previously detailed. This is a common form of bargaining, where only one individual has complete information regarding the value of an asset. While the economic prediction of this model is impasse, behavioural decision research has found that bidders follow naïve strategies and suffer from the winner's curse. For this study, I use version three of the original model<sup>21</sup>.

Only the seller has complete information regarding the value of his asset, they value it at  $v$ . In light of the true value of the asset, the seller can provide a pre-bid message to the buyer. Incorporating this component creates a signalling game. Traditionally, signals convey honest information for sellers when they are costly. Those receiving a signal can infer a sender's quality based upon the cost attributed to a given signal. As the message sent in this study is costless and nonbinding, it takes the form of cheap talk (Gibbons, 1992). A standard theory of signalling implies that this information is uninformative (Farrell, 1995).

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<sup>21</sup> The parameters of the model can be modified to test alternative pay-off structures and to produce alternative predictions of optimal buyer behaviour. Constant returns can be introduced regardless of the product's value and cumulative rather than uniform probability distributions can be applied.

For efficiency purposes, the value the seller claims to hold is restricted to five possible values when the model is operationalised experimentally (this is unknown to the buyer). Regardless of the true value of the seller's asset, it is in the best interest of any seller to tell a buyer they have a high quality asset given that a message is costless. The schematic in Figure 2.5 outlines the structure of the model and these claimed values.

The buyer does not know the value of the asset and considers  $v$  a random variable from a range of possible values that take the form of positive integers. Buyers are aware of the uniform probability distribution of possible values within the jointly known distribution  $f(v)$ ,  $[\pounds 0, \pounds 10,000]$ . The value for the buyer will be  $w(v)$  in light of this distribution. While the value of the asset to both parties will vary depending on the random distribution, regardless of  $v$ , the asset is worth at least as much to the buyer as it is to the seller. Thus,  $w(v) \geq v$  for all possible asset values. This represents gains that result from trade and ensures that reaching an agreement is welfare enhancing. As suggested, both the buyer and the seller are aware of the distribution  $f(v)$ , and are aware that  $w(v) \geq v$ . The seller however knows  $v$  and  $w$  precisely, with the buyer only holding probabilistic information of  $f(v)$ .

In spite of asymmetric information, both parties must settle on a price to trade; if no agreement on price is reached, an impasse results. For this model the asset is worth 50% more to the buyer than it is to the seller for all values and can be summarised as:

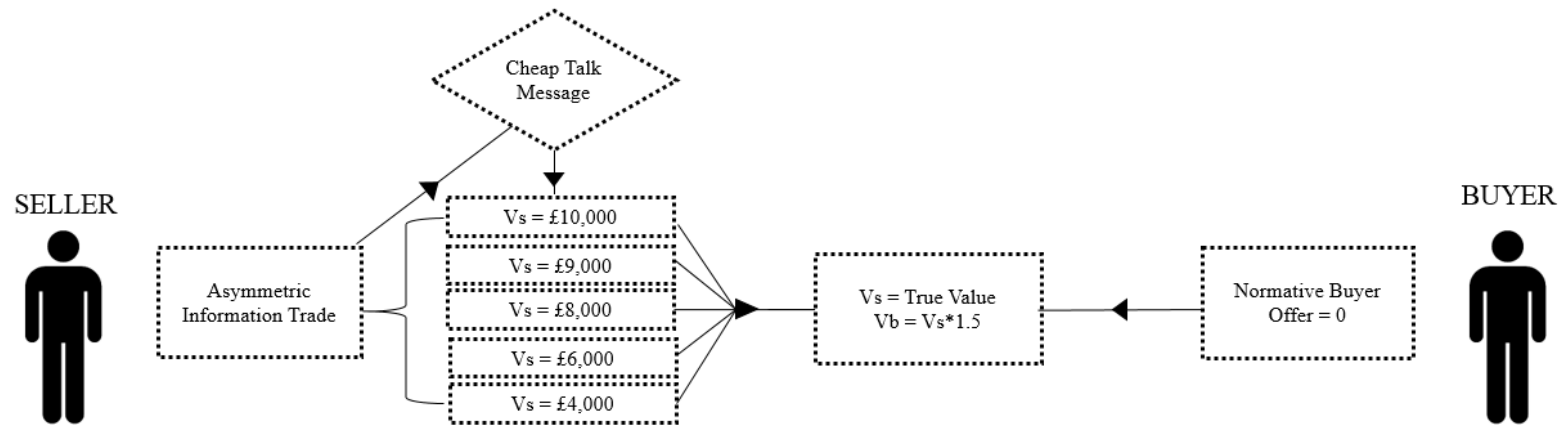
$$w(v) = v1.5 \text{ where } f(v) = v/10, \text{ for } v \in [\pounds 0, \pounds 10,000]$$

The only way a buyer can learn about the actual value of the asset depends on whether or not a bid is accepted. As a consequence of a costless message, buyers should not use a sellers' signal as an indication of quality. As suggested, this

message is an unverifiable disclosure and should not be treated as a credible claim.

Working under the assumption of selective acceptance, if a bid is accepted *on average* the expected return will be negative. As this logic applies to any positive bid, the optimal offer for a buyer is always zero and means no offer should be made.

**Figure 2.5 Schematic for Buyer Negotiation Model**



This schematic depicts the bargaining model and isolates the individual components that are operationalised experimentally. While the true value of the seller's asset is drawn from a uniform distribution and known to the seller, one of five cheap talk messages is randomly received by the buyer. Regardless of this message, a normative bidding strategy for the participant is to refrain from trade (bidding £0).



#### **2.7.4 Task, Experimental Design & Procedures**

The task follows an adaption of Valley et al (1998) and Di Cagno et al (2015) by introducing costless pre-play communication to the bargaining model. By bringing communication between the buyer and the seller before a bid is tendered, signalling is introduced to the model. The participants who receive this signal should take into account the cost of the signal when forming a bidding strategy.

As cheap talk is introduced, theoretically, buyers should discount the message. This is a costless signal. For any buyer, the message provided by the seller should increase the complexity of the problem through the addition of superfluous information but should not detract from the probabilistic structure underlying the payoffs.

To test if cheap talk influences the trust of buyers, this model is operationalized in a one-shot game using a between subject design. The experiment included five individual cheap talk treatments (visible in Figure 2.5). The narrative participants encounter is provided in the appendix. Participants are asked to play a game show where they are a buyer who must negotiate over the sale of ten locked boxes. The seller learns the value of the contents of these boxes and the participant must make an offer to the seller. The information asymmetry is public knowledge and participants are made aware that no future interaction will occur. They are also informed of the value of the boxes and that they are required to make only one decision. Participants randomly received one pre-play communication message and are then asked if they wished to make a bid.

To control the type of message a buyer received, participants negotiated with a computerised seller. The seller in each bargain is programmed to randomly provide

one of five valuations for their boxes. These values ranged from the seller claiming  $V_s = £10,000$  to  $V_s = £4,000$ . These claims are randomised for individual participants so that any one of five possible claims could be made to the buyer. Subsequent buyer bids are restricted to positive integers. No bid greater than £15,000 is allowed. An opt-out route is included before offering participants the possibility to bid. This is included to allow participants follow the normative strategy of refusing to enter the trade and preventing a potential response elicitation or demand effect.

In addition to carrying out the experiment, the participants are asked a series of qualitative questions relating to the extent they would agree with certain statements and are asked to provide a quantitative ability score (SRQA). These questions are available in the appendix and related to the buyer's perception of the influence of cheap talk.

The experiment is programmed in Qualtrics survey software. The general advantages of this software is that it allows cheap talk messages to be randomised and the game show to proceed in a logical fashion based upon a participant's choice. Furthermore, Qualtrics software allows visualisations to be incorporated into the task, thus aiding participants in understanding the task and what is required of them.

### **2.7.5 Participants**

Prolific Academic (PA) is the chosen platform to recruit participants for this experiment. This facilitated the recruitment of geographically and ethnically diverse participants. Specific pre-screening criteria is adopted to ensure high quality data collection. Only participants over 18 years of age with English as their official first language are recruited. Furthermore, only those with an Eligibility Requirements

Approval Rate (ERAR) of 90% that held a high post primary education are recruited<sup>22</sup>.

The text of the narrative has a Flesch reading ease of 76.2 and a Flesch-Kincaid grade level 6.1. These readability test scores indicate that the narrative should be easily read by participants. Given the pre-screening procedures, a participant pool of 10,888 participants remained (from an initial 41,050). Participants are randomly sampled from this stratified pool.

To ensure high quality data, two controls are introduced. Firstly, participants that fail the attention check question (ACQ/manipulation check) at the conclusion of the experiment are removed from the sample. This ACQ is available in appendix and the final sample subject to analysis must answer the ACQ correctly to be included in the dataset. Secondly, participants that progress past the payoffs and probability information in under half a standard deviation of the mean time are rejected; this constituted reading the main part of the experiment in under twenty-five seconds. This minimum timing threshold is devised in light of timed pilot experiments. 15% of the participants failed to either answer the ACQ correctly or meet the timing criteria (or failed to meet both). These participants are rejected, as they are deemed to have not understood the experiment.

Over the course of the experiment three sampling periods were required so that the sample correctly answered the ACQ and fulfilled the timing requirements. In the first sampling session 184 participants fulfilled the criteria successfully (30 rejections). 23 (6 rejections) and 4 participants (0 rejections) are recruited in the

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<sup>22</sup> ERAR is a measure of how diligently participant's performed in past studies.

second and third sampling round respectively. Participants are paid £0.50 for completing the task. This sampling strategy maximised the budget available.

To summarise, two hundred and eleven participants are recruited to conduct the experiment. This comprised of one hundred and eleven males and one hundred females. No personal information is collected on participants. Each participant could however be individually identified through personalised identification number; this ensured that no participants completed the task more than once. The average reading time of the payoffs and probabilities stage of the experiment is 38.96 seconds (SD = 25.82). The mean bidding time is 36.10 (SD = 27.11).

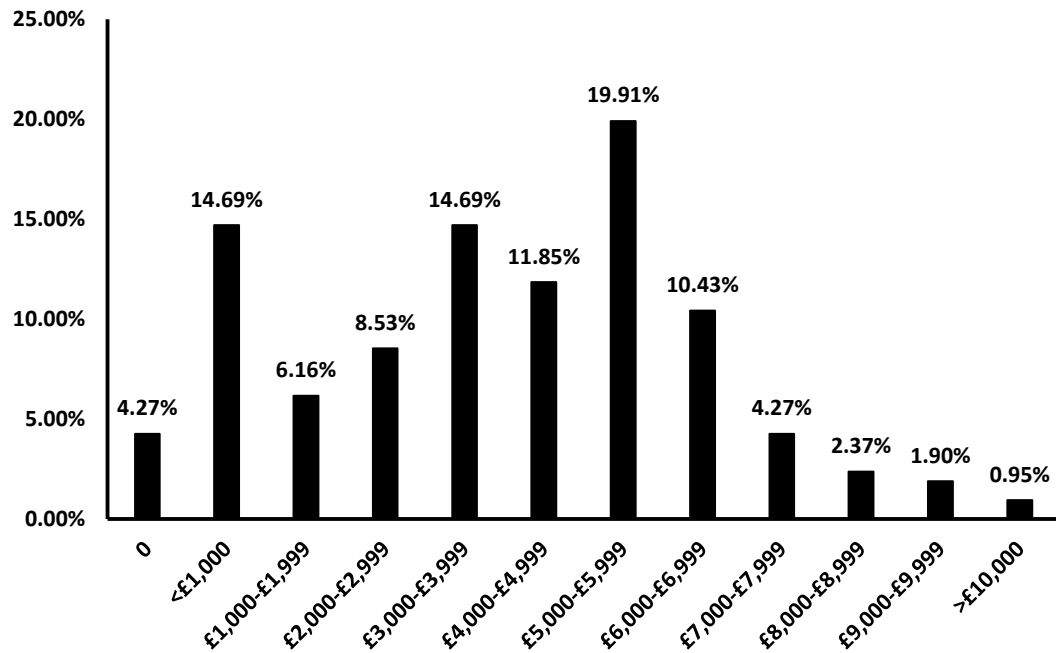
#### **2.7.6 Results**

Firstly, a high percentage of participants tender positive offers. Only nine participants (4.27% of the sample) follow a normative strategy of bidding £0<sup>23</sup>. This is relatively similar to the original findings of Samuelsson and Bazerman (1985) who observed that 93% of participants rejected the normative bidding strategy. The average bid, regardless of a cheap talk treatment is £3,631 (SD = £2,447). The median bid is £4,000. Figure 2.6 displays the distribution of bids for the entire sample. Similar to past studies on the AAC problem, the most frequent estimate is £5,000, the unconditional expected value of the asset.

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<sup>23</sup> This was relatively consistent with past research without cheap talk and pilots of this study where baseline effects (without cheap talk) are recorded. 6% of the samples played the solution concept in these pilots.

**Figure 2.6 Distribution of Bids (% of Total Sample, N=211)**



Turning to the outcome of the bargains, 46% result in impasse. Cursed winning bidders account for 35% of the sample. From seventy-four cursed trades, the average loss is £2,835 (SD = £1,804). Four neutral trades are reported. These constitute successful but non-welfare enlacing exchanges. Thirty-six welfare-enhancing trades took place. This constitutes 17% of the sample. The average surplus from a trade to the buyer is £1,789 (SD = £751).

To explicitly address the hypothesis, I now analyse the influence of heterogeneous cheap talk messages. Table 2.3 displays the descriptive statistics relating to bidding information for participants receiving different cheap talk messages across the bidding ranges and shows the restricted sample size for each cheap talk treatment.

**Table 2.3 Descriptive Statistics for Five Bidding Treatments**

Treatment (claim)	N	Mean Bid	SD	Min	Max
<b>1 (Vs =£10,000)</b>	45	£3,686	£2,916	£0	£10,500
<b>2 (Vs =£9,000)</b>	41	£4,379	£2,552	£0	£10,000
<b>3 (Vs =£8,000)</b>	41	£3,463	£2,802	£0	£9,000
<b>4 (Vs =£6,000)</b>	39	£3,351	£1,862	£0	£6,500
<b>5 (Vs =£4,000)</b>	45	£3,392	£1,858	£0	£8,000

Normative bidding strategies are observed in all cheap talk conditions. The confidence intervals for the five treatments at the 95% level are [£2,799.81, £4,572.90], [£3,573.65, £5,184.88], [£2,578.14, £4,346.97], [£2,747.66, £3,954.89], and [£2,833.43, £ 3949.89] respectively<sup>24</sup>. Figure 2.7 displays a box plot revealing the median and the range of bids across cheap talk treatments outlined in Table 2.3 (where group 1 corresponds to seller's claiming Vs = £10,000).

**Figure 2.7 Bidding for Alternative Cheap Talk Treatments**

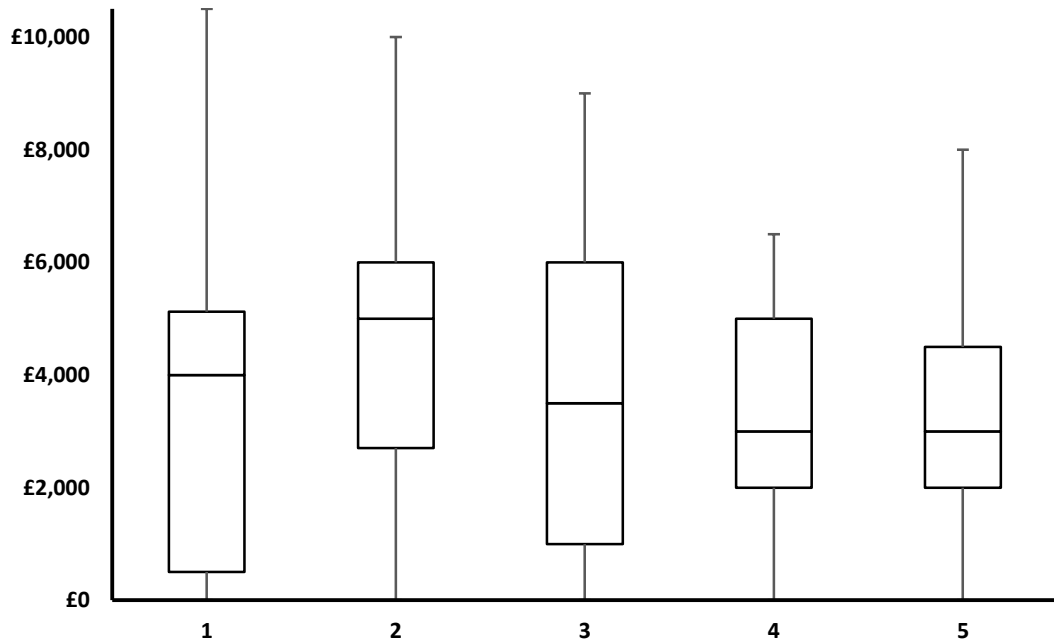


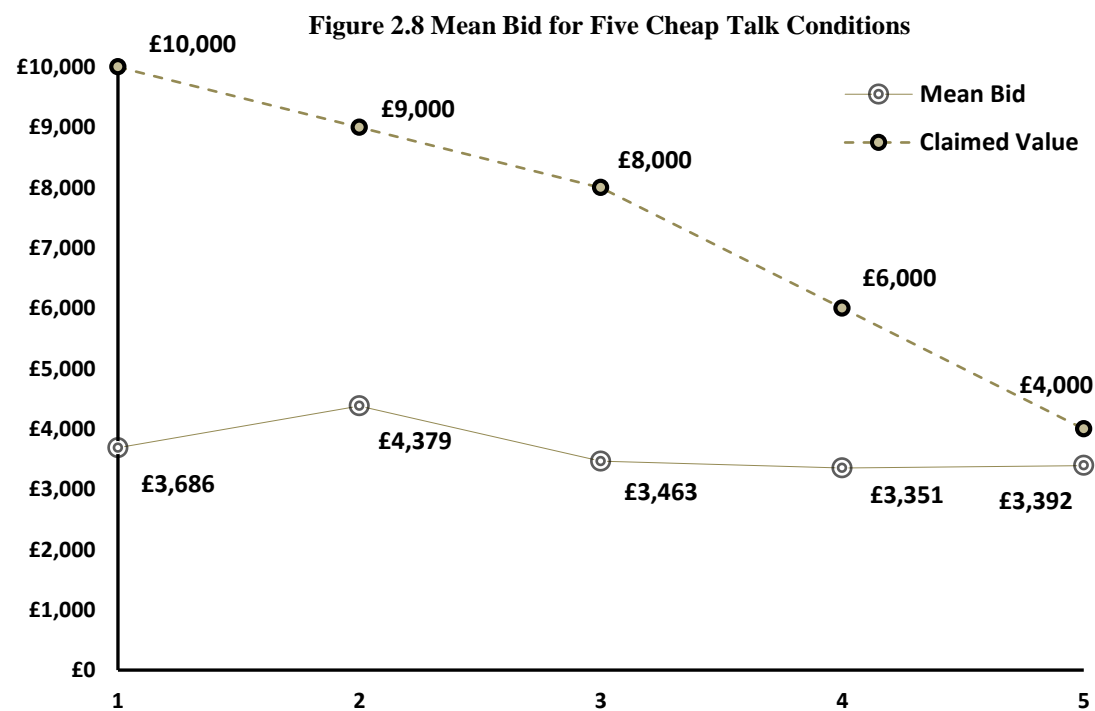
Table 2.4 and Figure 2.8 display the number of bidders per treatment and bidding category and the mean bid for the five alternative treatments, in light of the claimed

<sup>24</sup> Estimating effect sizes indicated that a minimum of 36 participants per treatment are required.

value. As measured by the difference between the claimed value and mean bid, the highest level of distrust is observed when sellers claim that their asset is perfect ( $V_s = £10,000$ ), with an average difference of £6,314 between the claimed value and mean bid (£3,686). The mean bid increases in treatment two and declines in the third treatment. In this sense, the level of distrust decreases as sellers claim to have lower value assets. Treatment one ( $V_s = £10,000$ ) observes the highest level of suspicion with the greatest number of participants bidding over £0 but under £1,000 for the boxes. The highest mean bid is elicited when buyers reputed to have an asset valued at £9,000, thus claiming a degree of deficiency.

Table 2.4 Number of Bidders per Treatment & Bidding Condition

Treatment/Bid	0	<£1,000	£1,000- £1,999	£2,000- £2,999	£3,000- £3,999	£4,000- £4,999	£5,000- £5,999	£6,000- £6,999	£7,000- £7,999	£8,000- £8,999	£9,000- £9,999	>£10,000	n
1 (Vs =£10,000)	2	12	3	0	3	5	10	4	3	0	2	1	45
2 (Vs =£9,000)	1	5	2	3	2	5	12	5	3	0	2	1	41
3 (Vs =£8,000)	3	7	5	3	3	2	6	7	1	3	1	0	41
4 (Vs =£6,000)	2	4	1	4	10	5	10	3	0	0	0	0	39
5 (Vs =£4,000)	1	3	2	8	13	8	4	3	2	1	0	0	45
Total	9	31	13	18	31	25	42	22	9	4	5	2	211





While the results observed in the descriptive statistics are numerically consistent with the hypothesis, that appearing perfect increases suspicion, inferential statistical tests reveal no significant statistical differences between the treatments. A one-way ANOVA to compare the differences in alternative bidding categories does not report a statistically significant difference between the treatments ( $p < .01$ ,  $F = 1.25$ ,  $p = 0.29$ ). Additionally, non-parametric tests are conducted given the relatively small samples. This allows one to make no assumptions concerning the underlying distribution of the data. A Kruskal-Wallis test to compare mean ranks for the five alternative bidding treatments also reports no statistically significant difference between the cheap talk conditions ( $\chi^2 = 4.98$ ,  $p = 0.284$ ). No one sub-sample stochastically dominates another.

Focussing solely on treatment 1 ( $n = 45$ ) with  $M = £3,686$  ( $SD = £2,916$ ) and treatment 2 ( $n = 41$ ) with  $M = £4,379$  ( $SD = £2,552$ ), an independent-sample t-test is performed to test if significant differences exists between the means bids of these individual treatments. This is analysed as it represents a change from appear perfecting to exhibiting a flaw. The distribution of bids is sufficiently normal in each treatment to warrant conducting a t-test (skewness; 0.387, 0.836, kurtosis; 0.202, 0.817). Furthermore, the assumption of homogenous variances across treatments is satisfied (a Levene's F test, reports  $F(83) = 0.19$ ,  $p = 0.163$ ). Although numerically different averages are recorded, an independent-sample t-test reports no statistically significant differences between both groups;  $t(83) = -1.1622$ ,  $p = 0.2485$ .

Consequently, the mean bids for those receiving a message that  $V_s = £10,000$  did not differ statistically from those receiving a message that  $V_s = £9,000$ <sup>25</sup>.

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<sup>25</sup> This statistical result is supported by a non-parametric test between the mean bids of these individual treatments; a Kolmogorov-Smirnov test reports a p value of 0.340.

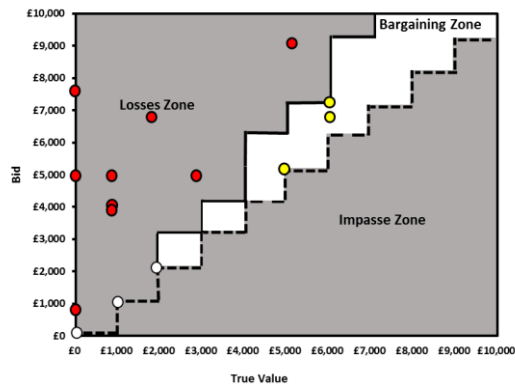
Although logically any cheap talk message should not influence a buyer's offer, 71% of the sample agreed with the statement that the seller's message influenced their bid, with 21% of participants consenting to cheap talk strongly affecting their bid. Despite the influence of cheap talk, buyers still displayed a high level of distrust following the message they are provided. Over 90% of participants in each of the first four subsamples tendered an offer lower than the value of the seller's claim. This distrust is highest when sellers appeared to have a perfect asset, claiming it to be worth £10,000. In this case, 98% of the sample made an offer lower than £10,000. The highest level of trust is observed in the final treatment, where a seller has claimed their asset is worth £4,000. In this treatment, 40% of the sample made an offer equal to or above the claimed value.

No substantial variation is observed between the bids of males (£3,941, SD = £2,487) and females (£3,375, SD = 2,410). Male and female buyers do not differ in their levels of suspicion with both displaying a high level of distrust in light of a cheap talk message. This finding is consistent with the recent experimental results of Di Cagno et al (2015).

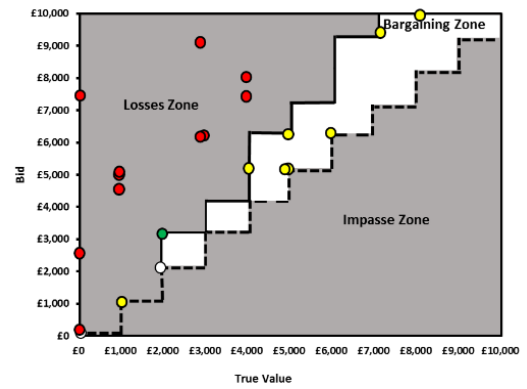
To consider the effects of trade and the influence of specific messages Figure 2.9 provides a visualisation of the trade outcomes from the buyer's perspective across the five treatments. The red data points indicate 'cursed trades' while the yellow data points signify welfare-enhancing trades (those which occur within the positive bargaining zone). The green data-points signify neutral trades.

**Figure 2.9 Trade Outcomes by Cheap Talk Condition**

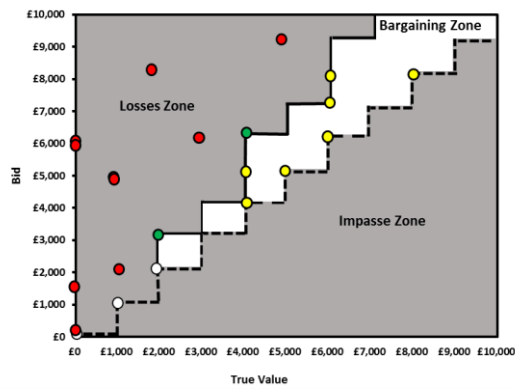
Seller Claim Vs = £10,000



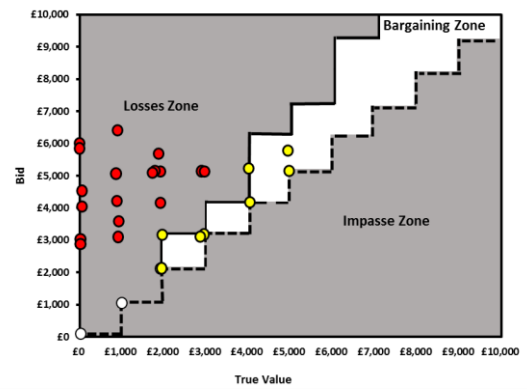
Seller Claim Vs = 9,000



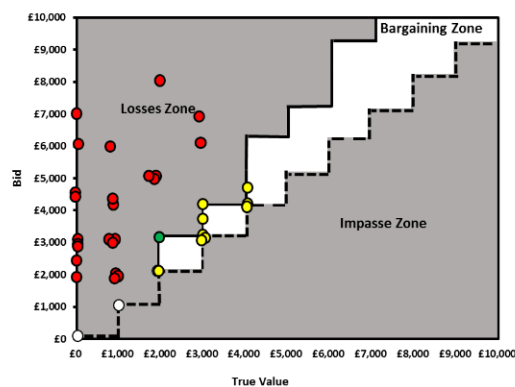
Seller Claim Vs = £8,000



Seller Claim Vs = £6,000



Seller Claim Vs = £4,000

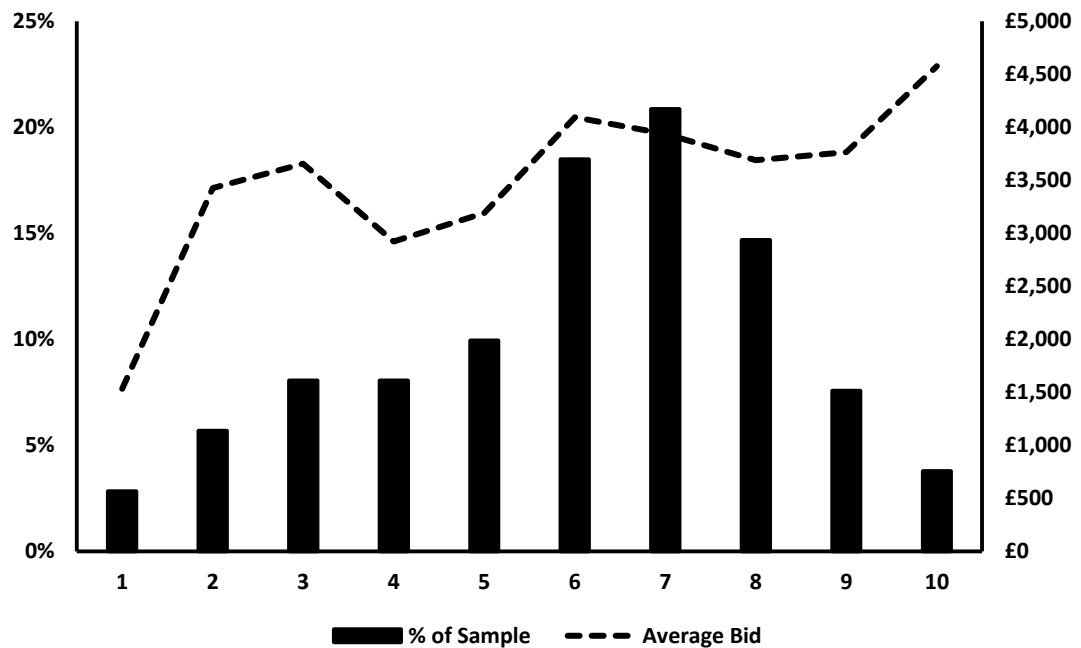


The lowest number of welfare enhancing trades occurred in treatment 1, when sellers claim  $V_s = £10,000$ . This treatment also observed the lowest number of trades in total (27% of the sample). When compared to treatment 1 ( $V_s = £10,000$ ), a greater number of welfare enhancing trades are observed as seller's claim to have lower valued assets ( $V_s = £9,000$ , 8;  $V_s = £8,000$ , 7;  $V_s = £6,000$ , 8;  $V_s = £4,000$ , 9).

Finally, no evidence exists to suggest that self-reported quantitative abilities relate to a participants' optimal performance in the task. The average SRQA score is 6/10.

While no participant's that followed the normative strategy submitted a SRQA below 5, a participants' optimal performance in the task did not relate to their SRQA. Oppositely, the average bid for participants with a SRQA of 10/10 is the highest for the entire sample while the lowest SRQA recorded the lowest bid on average (albeit small sample sizes existed for both). Figure 2.10 displays the mean bids for the alternative SRQA levels. The left hand axis measures the percentage of the sample that reported a specific SRQA and the right hand axis measures the average bid. Atypically, a correlation exists between higher SRQA scores and higher bids ( $R = 0.7524$ ).

Figure 2.10 Mean Bids for SRQA Levels



### 2.7.7 Discussion & Conclusion – Experiment I

This experiment began by questioning whether cheap talk can have subtle psychological effects using the AAC bargaining model. In particular, the study hypothesises that appearing perfect when bargaining under uncertainty can cause one to be trusted less. As Figure 2.8 displays - sellers are trusted more, as measured by difference between the claimed value and mean bid, when they claim to hold an asset of lower value. Even though this claim is non-credible and costless, buyers show a tendency to distrust sellers who appear perfect. Whilst no statistical differences are observed between cheap talk treatments, sellers are distrusted most when they claim that their asset is perfect (treatment 1,  $V_s = £10,000$ ). The prevailing levels of suspicion expressed in buyer's bids, coupled with a consensus from buyers that a seller's claim matters, suggests that buyers find it challenging to ignore the noise that is a cheap talk message.

Despite a common incidence of cursed winning bids across all cheap talk treatments, the frequency of trade increases as seller's claim to have lower value assets. A seller's claim that  $V_s = £10,000$  is associated with the lowest levels of trade. The higher rates of impasse observed in this treatment supports the hypothesis that high valued claims are treated with greater levels of suspicion. Despite the lack of statistically significant results, the rate of welfare enhancing trades increases when sellers claimed a degree of imperfection at  $V_s = £9,000$ .

The results reported in this experiment add to the literature that consider the role of communication effects in bargaining. In a general sense, it supplements the literature which questions if decision-making is affected by uninformative interactions. In particular, this experiment builds on the work of Valley et al (1998) and Di Cagno et al (2015) who explore the role of communication in the AAC game. The results generate further interesting questions relating to communication. Firstly, buyers generally agree that cheap talk influences their bidding behaviour. Do buyers anchor on this information or does the insertion of cheap talk increase the strategic complexity of the adverse selection problem further? Only 4.27% of the sample disregarded the cheap talk message and offered a bid that reflected an equilibrium strategy.

Inclusive of this study, research on the effects of cheap talk communication in the AAC problem has explored the effects of the medium of communication, the role of gender and, now, the impact of alternative messages. Several directions exist to explore the influence of communication further. One specific avenue open to future research is the need to demonstrate the specific value of alternative credible signals for sellers. This study has provided a benchmark measure of the bidding behaviour of informed buyers, when messages are costless. The question remains whether a

credible and costly signals would be ‘worth it’ for the seller given the bidding behaviour of participants in cheap talk treatments. Estimating the difference between costly and cheap signal is a viable avenue for future research for literature concerning communication and the AAC game.

The aim of this experiment was to explore subtle communication effects in the AAC bargaining model, thereby providing a richer descriptive account of bargaining scenarios. In particular, this experiment focused on importing insights from social psychology to the domain of bargaining. Whereas initial research on the AAC problem could be classified as asocial, several previous articles have investigated strategic nuances of bargaining by incorporating communication to this game-theoretic model. Theoretically, sociality in the form of cheap talk communication should not influence another party, or provide a resolution to the underlying adverse selection problem. This has been argued theoretically for a long time but relatively few research articles have explored this claim experimentally (Farrell & Gibbons, 1989). I investigated this further by asking whether a specific cheap talk message alters intrapersonal attractiveness and trust of those receiving a message.

To recap, the key finding is that a negligible number of participants (4.27%) follow a normative bidding strategy and discount the cheap talk message. Cursed winning bidders accounted for 35% of the sample and 46% of the trades resulted in impasse. Although no statistically significant differences exist across cheap talk treatments, the highest level of distrust is observed when sellers claim that their asset is perfect (treatment 1,  $V_s = £10,000$ ). This treatment also holds the fewest successful and welfare enhancing trades. While buyers do admit to being swayed by cheap talk, a considerable degree of distrust remains; this is evident from the low number of participants (<10%) who bid equal to or above the seller’s claim. The reported

SRQA does relate to a participant's performance in the task but not in the direction one would expect.

## **2.8 Experiment II: Insights to Seller Psychology in Bilateral Bargaining**

### **2.8.1 Background & Key Findings**

Since its development by William Samuelson and Max Bazerman (1985), experimental tests of the AAC bargaining game have largely focused on buyer (acquirer) behaviour, both in terms of the efficiency of trades and the buyer's ability to learn to minimise losses. Extensive empirical evidence has documented the naïve bidding strategies on the part of buyers (Samuelson and Bazerman, 1985; Ball et al, 1991; Foreman & Murnighan, 1996). Even experienced participants frequently formulate a bid that is equal to its unconditional expected value and thereby suffer from the *winner's curse*, failing to appreciate the information embedded in a seller's acceptance decision (Bazerman, 2002). In general, this curse is robust to strong learning techniques but can be diminished by training individuals (Idson et al, 2004).

The aim of this experiment is to develop the AAC problem by concentrating on the rationality of sellers. To date, little attention has been placed on seller behaviour in this game. It appears an implicit assumption (and depending on the methods adopted can also be a required auxiliary hypothesis) that buyers participate against a seller who adopts rational strategies and exploits lesser informed individuals through a precise decision rule. This decision rule derives from the idea of selective acceptance – a rational seller will not trade an asset for less than its worth. Thus, buyers can only learn about the true value of an asset by having a bid accepted or rejected. This second experiment explores whether sellers behave optimally, anticipating the contingencies associated with more information and thus having the foresight to strategically avoid information.



I hypothesise that sellers will choose more information over less and will opt into a setting characterised by asymmetric information, thereby failing to foresee the future contingencies of their choices. Such a decision is naïve as it fails to acknowledge the interdependences of the negotiation and the gains from trade that can transpire from choosing to avoid additional information. While a rational analysis in this game would suggest that ignorance allows a potential solution, I propose that the temptation of more information may be too much for a seller who may succumb to ‘cursing’ themselves by accessing new knowledge. A rational analysis shows that this causes trade to break down.

The experiment is designed so to introduce a preliminary step to the AAC game and establish an individual choice task to ask whether sellers naively opt into an asymmetric (as opposed to a default symmetric) information setting established in the AAC bargaining model. The design, is based on an adaption of Samuelson and Bazerman’s (1985) original AAC game. Identical parametric structures to the experimental work of Samuelson and Bazerman (1985) and later Ball et al (1991) are applied.

The rationale for this study began with a theoretical insight for the AAC model (version 3 - Samuelson & Bazerman, 1985). This is that two-sided symmetric but imperfect information in bilateral bargains, (while obviously less effective than a two-sided symmetric complete information setting - full disclosure), should, on average, produce a greater number of welfare enhancing agreements than bargains characterised by one sided asymmetric information (impasse). This experiment seeks to consider this logic experimentally. Specifically, this experiment asks whether (i) participants adopting the role of sellers can understand the benefits of both parties in a trade remaining equally unenlightened rather than obtaining more information and

(ii) whether a greater number of two-sided symmetric but imperfect information settings produce a greater number of welfare enhancing exchanges.

Both (i) and (ii) are important questions to test. Non-normative strategies adopted by sellers logically harm the allocation of resources. In scenarios of one-sided asymmetric information bargaining should conclude with impasse, once specific parameters are posited (Akerlof, 1970). Experimental and behavioural economists however have yet to empirically test whether sellers in bargaining understand the perils of additional information and whether those that do, produce a greater number of welfare enhancing trades than bargainers ‘cursed’ by knowing more. Extra knowledge or expertise has been recognised as a ‘cognitive handicap’ that leads one to underestimate the challenges unaware parties face (Hinds, 1999).

Additionally, this work is concerned with the strategic behaviour of sellers whom opt into one-sided asymmetric information bargaining. Whereas ‘cheap talk’, in experiment I is computerised, it remains to be seen whether sellers engaged in alternative forms of deception. These alternative forms would be contingent on the true value of their asset. Supplementary questions important to this experiment include asking what messages sellers send to buyers if given the opportunity. Do sellers act deceptively in alternative means when provided with a flawless or worthless asset? While deception is a complex phenomenon, occurring in multiple forms, the standard game-theoretic and formal interpretation of deception involves one agent in a negotiation sending information to another that does not match their actual ‘type’. With this definition, deception is measured by the frequency of imprecise states of nature revealed by individuals. For a detailed classification of deception, that includes many behavioural examples, see DePaulo, Kashy, Kirkendol, Wyer, and Epstein (1996 P.983). The authors distinguish between the

content of a lie, its reason, its extent and its target. A similar classification of lying is provided by Lewicki (1983).

The major finding of experiment II is that decision makers frequently choose to take additional information in a setting where accessing it is not advantageous to trade. Only 22% of the sample followed normative decision rules, a strategy which qualitative evidence suggests is not informed by purely rational inferences.

The next section of this experiment briefly reviews related literature that is specific to this research question but outside central literature previously considered for the AAC game. Interdisciplinary perspectives that consider the disadvantages of extra information and the ‘curse of knowledge’ are reviewed. Section 2.8.3 briefly recaps the bargaining model and describes the additions to the basic model. Section 2.8.4 introduces the experiment. This section considers matters relating to the design and procedures. Section 2.8.5 introduces the participants and 2.8.6 outlines the results. Section 2.8.7 discusses the findings and concludes the experiment.

## **2.8.2 Related Literature**

The idea that less information in bargaining can be advantageous is not a new suggestion. Schelling (1957) reasoned that lesser informed bargainers can gain an advantage over better informed antagonists. Three years after this insight Schelling outlined how ignorance can also be a useful commitment mechanism (Schelling, 1960). Both of Schelling’s works conceived less information as compatible with standard economic theory.

Past experimental research has tested for the perverse effects of additional information relative to a counterpart. When it is wise to ignore additional information that only one party is privy to, individuals find it challenging to exploit

their information advantage in markets (Camerer, Loewenstein, & Weber, 1989). This 'curse of knowledge' implies that better informed parties may suffer losses when they hold additional information that they should selectively disregard or at times completely ignore. For instance, Camerer, Loewenstein and Weber (1989) conducted a two-stage study on fifty-one Wharton University students. The participants were firstly asked to predict the value of eight companies. Next, a second group of students were informed of the actual earnings of the companies and were required to trade assets in a double oral auction where the dividend is identical to the predictions of fifty-one students. Thus, this group had access to the actual company earnings. The trading results showed that prices generally started in the range of a 'pure-bias' and 'no-bias' prediction and move away from the pure bias condition. The known information is only partially discounted. In a separate experiment the authors showed that incentives and feedback did not reduce the bias but that market forces could.

Smith (1991) also reported results from a continuous double auction where knowledge worked to the disadvantage of better informed participants in a market context. In Smith's (1991) experiment complete and private information conditions were compared. The evidence revealed that convergence to the equilibrium prediction occurred more rapidly under the private information condition than it did under the common, complete information condition.

Finally, Keysar, Ginzel and Bazerman (1995) conducted an experiment where participants predicted buyer behaviour in a negotiation game. When participants knew the true value of the firm for sale they believed that buyers would be more willing to complete a sale when the negotiation is closer to the true value of the asset, even though the buyer still had to bid under uncertainty (the buyer is unaware

of the true value of the firm). Keysar et al (1995) conclude that their evidence constitutes as further validation for the curse of knowledge hypothesis.

The general idea of the curse of knowledge has been applied to various domains since its initial application in economics. The most prominent borrowing has occurred from the fields of social and developmental psychology, where the curse of knowledge has been used as a tool to understand both adults' and children's difficulty in appreciating low levels of perspective taking (Birch, 2005; Birch & Bloom 2003). Table 2.5 provides an insight to the alternative domains in which the general idea of the 'curse of knowledge' has been applied since Camerer, Loewenstein, and Weber's (1989) contribution.

**Table 2.5 The Curse of Knowledge – An Interdisciplinary Perspective**

Author	Year	Domain of Application	Consequences
Camerer	1992	Design/Engineering	The designers of technological equipment can underestimate the challenge posed to the users in terms of learning how to work specialised goods.
Kennedy	1995	Accountancy; Auditing	Auditors who are aware of unaudited book values may direct excessive attention to these accounts and fail to detect changes in other accounts.
Hinds & Pfeffer	2003	Organisational Theory	The curse can act as a cognitive limitation that acts as a restraint to knowledge transfer in organisations.
Nathan & Petrosino	2003	Education	‘Expert blind spots’ can affect those with expertise in a subject matter, leading to higher standards being required from student learners.
Bibas	2004	Law	The amount awarded by judges can be lower when a motion is not previously heard.
Birch	2005	Developmental Psychology	The curse biases adults but importantly children’s social cognition, contributing to limitations in mental reasoning.
Tobin	2009	Media; Entertainment	Writers often take advantage of the curse of knowledge suffered by the viewer. This allows narrators to satisfy the audience with increased suspense.
Pinker	2014	Linguistics	The curse imposes a communication limitation on writers who appeal to specific rhetoric and thus fail to comprehend the mental model of the reader.

### 2.8.3 The Bargaining Model

This section presents a condensed and adapted version of the basic negotiation model outlined in greater detail in section 2.3.1. This abridged version recaps on the essential features of the model and explains any additional features to the information structure of the game.

The seller and the buyer do not know the value,  $v$  of an asset and consider  $v$  a random variable from a range of possible values that take the form of positive integers. Both parties are aware of a uniform probability distribution of possible values within the jointly known distribution  $f(v)$ ,  $[\pounds 0, \pounds 10,000]$ . The value for the buyer will be  $w(v)$  in light of this distribution. While the value of the asset to both parties will vary depending on the random distribution, regardless of  $v$ , the asset is

worth at least as much to the buyer as it is to the seller. Thus,  $w(v) \geq v$  for all possible asset values. This represents gains that result from trade and ensures that reaching an agreement is welfare enhancing. Both the buyer and the seller are aware of the distribution  $f(v)$ , and are aware that  $w(v) \geq v$ .

Both parties must settle on a price to trade; if no agreement on price is reached an impasse occurs. The asset is worth 50% more to the buyer than it is to the seller for all values and can be summarised as:

$$w(v) = v1.5 \text{ where } f(v) = v/10 \text{ for } v \in [\pounds0, \pounds10,000]$$

Neither the buyer nor the seller however knows  $v$  and  $w$  precisely, and hold probabilistic information of  $f(v)$ . With equal information the expected value to the seller is half of the total value. As suggested in the background (2.8.1), I hypothesise that sellers will fail to foresee the implications of additional information, an action that will destroy the attractive properties of exchange. The normative strategy for a seller would be to refuse additional information and not learn the true value of the asset they have been endowed with<sup>26</sup>. By not having additional knowledge the true value of the asset would remain unknown to both the buyer and the seller. By introducing a preliminary step, a third move is added to the model; the initial choice to learn the value (move 1) is followed by the (computerised) buyer's *rational* estimate (move two). Subsequently, the seller faces an acceptance or rejection decision (move three) The introduction of this first move is in contrast to the traditional two-stage sequential move game.

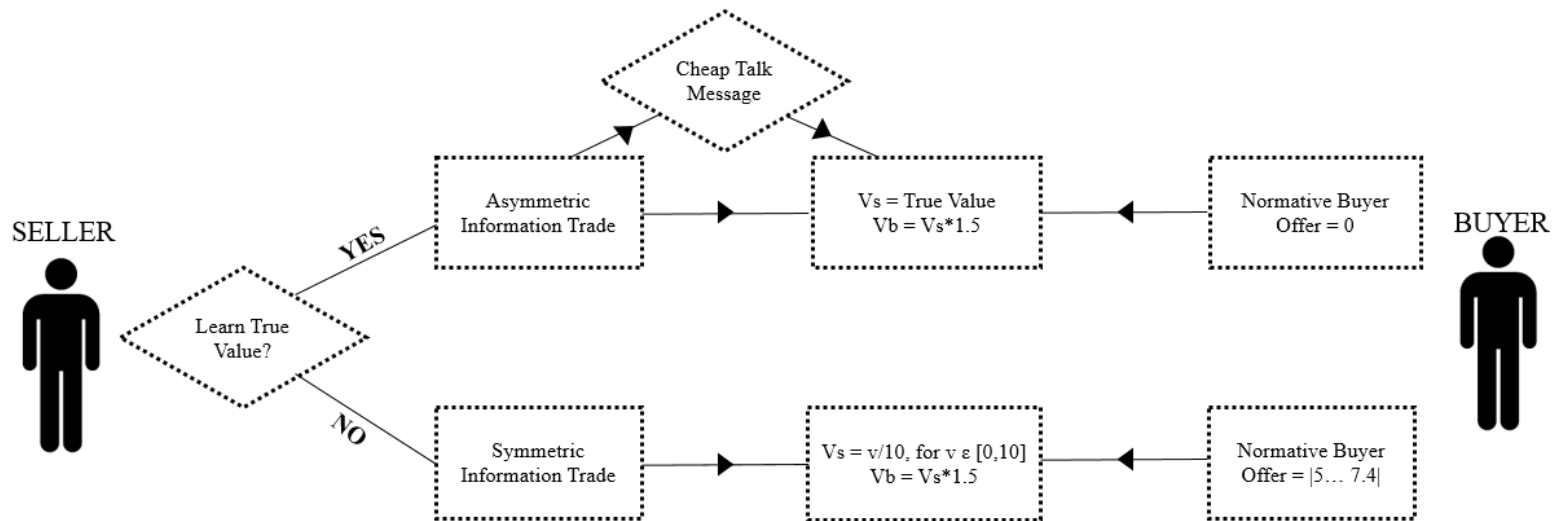
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<sup>26</sup> It is assumed that sellers would not seek to gain additional information to take advantage of, what they believed to be, naïve buyers. Qualitative analysis of the responses in this experiment never revealed this as a reason to take extra information.

In light of the structure of the game, a rational buyer under a setting of symmetric information (dual asymmetric information) should tender an offer between the expected value of the boxes to the seller up to the 50% greater than this expected value. This would naturally vary depending on a buyer's appetite for risk. The rational strategy for buyers is to make a bid that is between half of the total value up to the expected value (£5,000-£7,500). A risk neutral seller should accept any bid equal to or above the expected value of the asset (£5,000). On the contrary, if a seller chooses to learn the true value of their asset, they enter a negotiation characterised by one-sided asymmetric information (the AAC game). Regardless of any communication they have with a buyer the true value of the contents is known to the seller and there is no positive bid at which a buyer can expect to make a profit on average based on the rules, payoffs and probabilities. The schematic below provides an insight to the model from the seller's perspective and the normative strategy one could expect sellers to follow.



**Figure 2.11 Schematic for Seller Negotiation Model**



The schematic in Figure 2.11 displays the bargaining model and isolates the individual components that are operationalised experimentally. The seller's initial choice to choose more or less information will direct the trade down one of two possible pathways. The rational buyer will refrain from trade (offering £0) if a participant chooses additional information. The buyer will make an offer in the symmetric information trade.

#### **2.8.4 Task, Experimental Design & Procedures**

The task involves a novel version of the AAC game focusing on the sellers' side of the bargain. The probability and payoff structure of the game adopt the same parametric structure of Samuelson and Bazerman – Version 3 (1985), Carroll et al (1988), Ball et al (1991) and Valley et al (1998). Participants are faced with a uniform probability distribution as outlined in the previous section. At the outset of the experiment the true value of the asset is unknown to both the buyer and the seller. Thus, a third stage is added to the game where the seller has a choice whether or not to access additional information.

This model is operationalized in a one-shot game, similar to that of the previous experiment. The narrative participants encounter is provided in the appendix.

Paralleling experiment I, participants play a game show where they are a seller who must negotiate over the sale of ten locked boxes. Each participant is given the role of the seller and are informed that their objective is to make as much money as possible. All participants are asked whether or not they wish to view the true value of their asset (a decision which is known to the buyer). If participants choose to look inside their boxes they are freely accessing more information.

Once this occurs, the economic prediction is that the bargain ends in impasse. The rational decision of a buyer is not to enter negotiations. If a seller chooses to remain equally uninformed, rational buyers should offer an amount between the average values of the boxes to the seller up to the expected value of the asset to them, a value which risk neutral sellers would accept. The buyer is programmed to be a risk neutral, rational buyer. This entailed two strategic responses outlined in the previous schematic; either (i) offering a bid of £0 if sellers chose to learn the true value of their asset or (ii) offering a bid of £5,000 if sellers rejected additional information.

As a corollary, if a participant chooses more information they are also asked to send a (cheap talk) message to the seller. This message concerns how many boxes are empty. For the entirety of the experiment participants negotiated with a computerised buyer that always followed a normative bidding strategy that is not contingent on the message they received. For instance, if a participant chooses to learn the value of their boxes, regardless of their true value, the computerised buyer did not deviate from the equilibrium strategy of a £0 bid.

In addition to carrying out the task, the participants are asked a series of qualitative questions which gave them an opportunity to explain their motivations for seeking/not seeking additional information, the strategy behind the message they sent (if they choose to look inside the boxes) and other questions relating to how much they believed a message would alter a buyer's strategy. These are introduced to build an accurate assessment of whether participants foresee the contingencies associated with their choice.

The experiment is programed in Qualtrics survey software. There are multiple advantages of using Qualtrics for this specific experiment. Specifically, for this experiment the software allowed all sellers to negotiate with a rational buyer who followed consistent decision rules based on a participant's choice.

Prolific Academic (PA) is the chosen platform to recruit participants for this experiment. As is the case with experiment I, a clear pre-screening strategy is formed. This is adopted to ensure high quality data collection. Only participants over 18 with English as their official first language are recruited. Furthermore, only those with an ERAR of 90% that held a high post primary education are recruited. As an

additional filter, participants that had previously taken part in related tasks are prevented in accessing the experiment.

The text has a Flesch reading ease of 74.8 and a Flesch-Kincaid grade level 6.1. These readability test scores indicate that the narrative should be easily read by participants. Given the pre-screening procedures, a participant pool of 11,608 participants remained (from an initial 44,406). Participants are randomly sampled from this stratified pool.

### **2.8.5 Participants**

198 individuals participated in the experiment. Participants are recruited from two general populations; online participants (through the PA platform) and university students.

An ACQ control (manipulation check) is included to ensure that participants understood the probabilities and payoffs of the game. This ACQ is available in appendix. Participants that could not answer this question correctly are likely to have not understood the task. Four participants failed to complete the survey and seven participants incorrectly answered the ACQ. These seven participants also only spent between six and twenty-two seconds reading information on the games payoffs and probabilities, this is far below the average time of 57.1 seconds and hence these observations are removed from the sample, leaving a remaining forty-seven responses.

The online version of the experiment is conducted via PA. To ensure high quality data using PA, two controls are introduced. Firstly, participants that failed the ACQ survey are removed from the sample. Secondly, (and as is the case in experiment I) participants that progressed past the payoffs and probability information in the

experiments in under half a standard deviation of the mean time are rejected. 15% of the participants failed to either answer the ACQ correctly or met the timing criteria (or failed to meet both). This constituted 32 submissions. These participants are rejected, as they are deemed to have not understood the experiment. A resampling process commenced for replacement participants. In total two sampling period were required so that the sample correctly answered the ACQ and fulfilled the timing requirements. Participants are paid £0.35c for completing the task that took approximately four minutes. This sampling strategy maximised the budget available.

A total of fifty-eight university participants are also recruited to conduct the experiment via the Qualtrics software. These participants constituted undergraduate finance studies in University College Cork. Twenty-eight are female and thirty are male. The participants are aged between nineteen and twenty-two and had no previous training in game theory. All participants would have completed an introductory course to statistics and quantitative methods.

### **2.8.6 Results**

The primary variable of interest in this study is seller cognition in relation to their decision whether to access more information. On average participants took 22.66 seconds to reach their decision to learn the true value or not. This indicates that the chosen strategy is not done so in haste. As hypothesised 155 participants (78%) followed a naïve strategy and choose to learn the value of their asset, thereby entering an asymmetric information negotiation setting (AAC game) with the buyer. The remaining 43 participants choose to sustain the default symmetric information setting.

This result suggests that the majority of sellers, in a similar vein to the majority of buyers who partake in the standard AAC game, fail to foresee the implications or contingencies associated with their decision. Sellers are generally not cognisant of any impending normative logic which is implied in the information structure and rules of the game when making their decision. Of the 155 participants that failed to follow the normative strategy, 148, refused the (rational) buyer's equilibrium bid of £0. This resulted in 148 impasses. 7 participants accepted the normative bid of £0, as they are randomly drawn a worthless asset. Although this trade occurred it is not welfare enhancing.

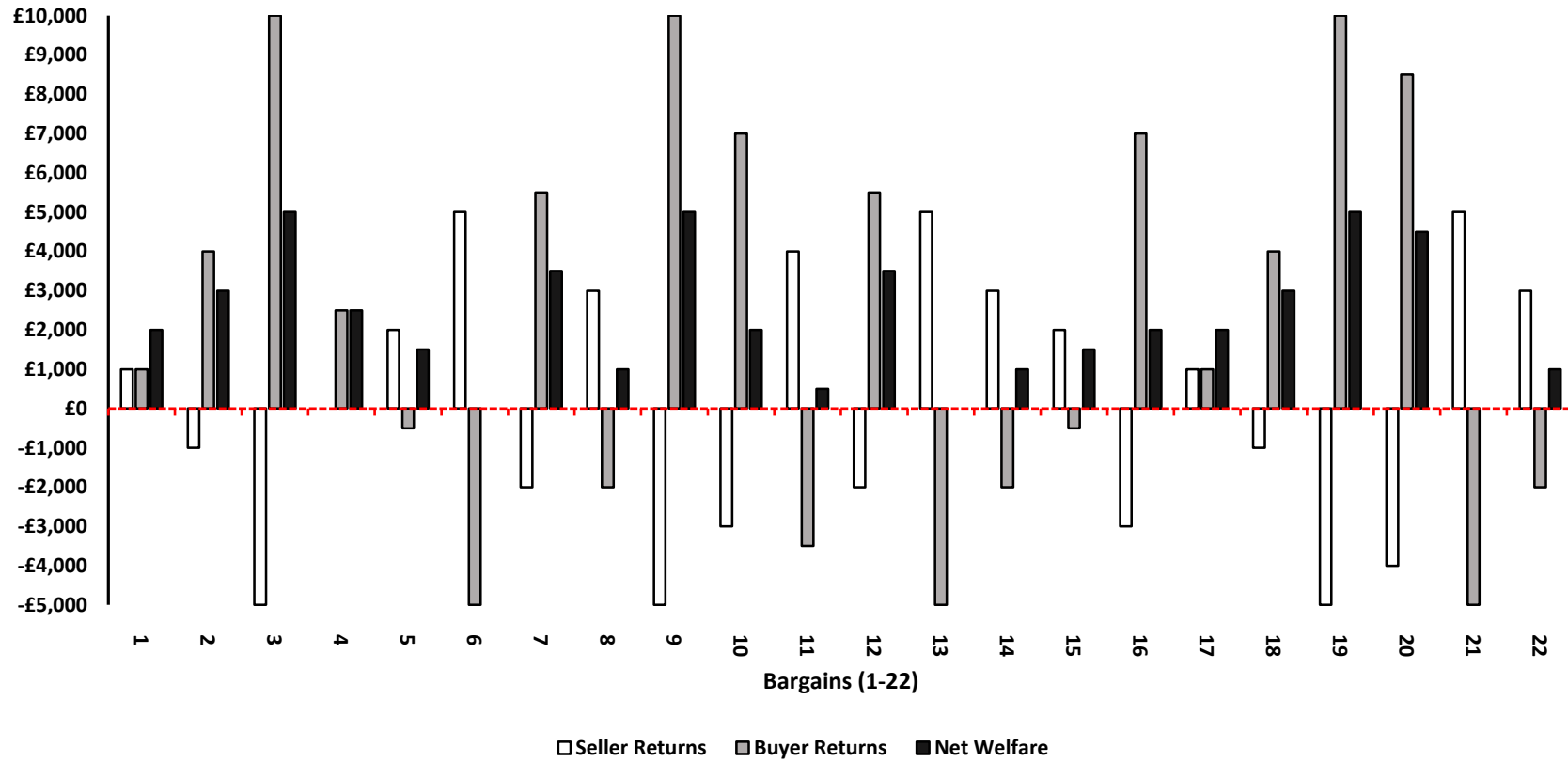
The average SRQA of the sample is 6.51 (SD = 2.14) where 0 is 'extremely weak' and 10 is 'extremely strong'. No difference is observed between the SRQA of those that choose to look inside the boxes (6.49, SD = 2.19) and those that did not (6.58, SD = 1.96). An unpaired t-test confirms that no statistically significant difference in self-reported quantitative skills exists across those who access and do not access additional information ( $T=-0.2282$ ,  $p = 0.8197$ ). No differences relating to gender or the alternative samples (university students versus PA) is observed. Of the 43 participants that followed the normative strategy, 22 sellers traded (11% of the total sample) while 21 rejected the bid of £5,000. This increased the rate of impasse to 85% of trades.

An important question to consider is whether a rational buyer returns higher gains from trade when participants choose not to look in their boxes. At a minimum, accepted bids from those who traded produced a neutral net welfare gain. The average distribution of the welfare gain across the 22 trades is as follows. 13 of the 22 trades resulted in positive gains for the buyer. Accepted bids under symmetric information (dual asymmetric information) resulted in, on average, positive net

returns of £2,295 for the buyer. Positive seller returns took place in 11 of the 22 trades. On average, accepted bids resulted in positive net returns of £136 for the seller. This result suggests that risk sharing through information avoidance can increase the efficiency of exchanges.

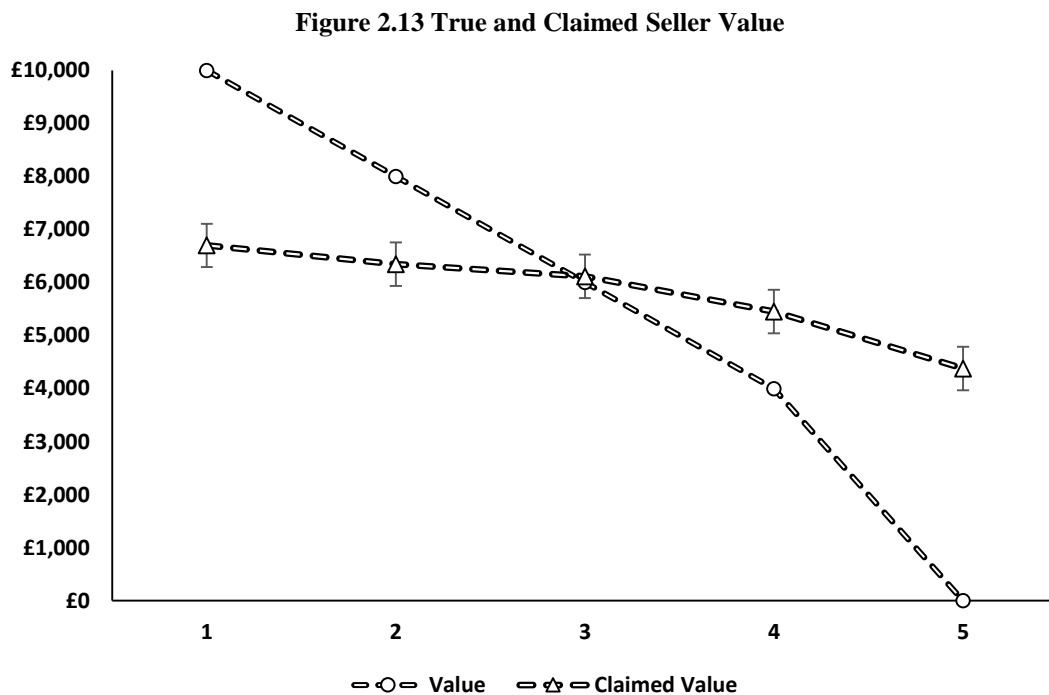
Figure 2.12 displays the returns to buyers and sellers for these 22 exchanges. In addition to the distribution, the net welfare effect is displayed. 3 of the 22 successful trades resulted in neutral (baseline) net welfare effects.

Figure 2.12 Returns Distributions with Normative Bidding Strategies





The 155 participants who choose to learn the value of their boxes also are given an opportunity to send the buyer a (cheap talk) message regarding the true value of their asset. As suggested in the rationale, exploring strategic behaviour on the part of the seller, especially deceptive behaviour, is of interest and a natural follow on from experiment I. Figure 2.13 displays the average value sellers claimed their boxes to be worth in light true value. For efficiency purposes, sellers are allocated to one of five treatments (10, 8, 6, 4 or 0 gold coins – these correspond to groups 1 through to 5). As any participant that choose to look into the boxes are randomly drawn one of the five treatments, the sample sizes for the groups ranged from 29 to 31.



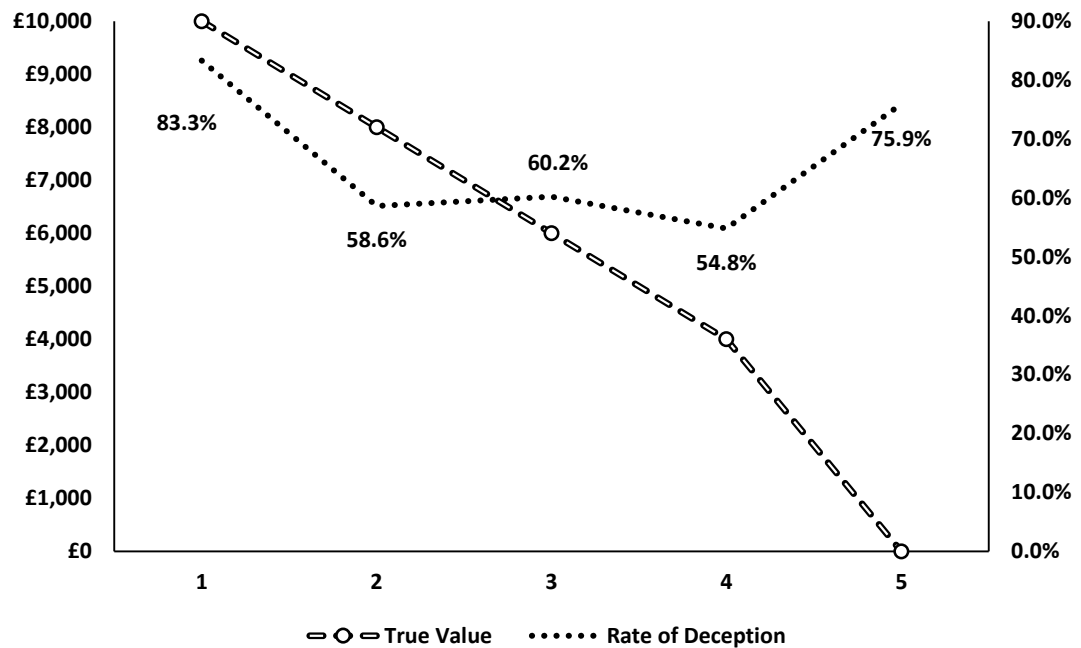
On average sellers claimed that their boxes are worth between £4,379 and £6,700 regardless of the true value. Sellers that had a ‘perfect’ asset (treatment 1) underrepresented its true value, on average claiming that their boxes are worth £6,700. Participants underrepresented the true value of assets worth £8,000 but did so to a lesser extent to treatment 1 (£1,656 undervalued as opposed to £3,300

undervalued in treatment 1). On average, participants overestimated the value of boxes worth £6,000 to £0. The boxes worth £4,000 and £0 are on average claimed to be worth £5,451 and £4,379 respectively. A Kruskal-Wallis test to compare means ranks across the treatments reports a statically significant differences ( $\chi^2 = 13.135$ ,  $p = 0.01$ ). No statistical difference between genders are observed. Of the 155 participants that choose additional information, the 86 males and 69 females both overvalued their asset on average ( $M = £500$ ,  $F = £642$ ).

A Likert scale is used to measure whether sellers believed that their message influenced the decision of the buyer (0 = strongly believing that a message would influence the buyer's bid; 100 = strongly disagreeing that a message would influence the buyers bid). The mean reported score for this scale is 36.93 ( $SD = 30.05$ ). Nine participants that opted for additional information strongly disagreed (100) that their message would influence the buyers bid. This data could be interpreted as further evidence that individuals failed to foresee the contingencies associated with learning the true value of their boxes. Participants with additional information believed that their message would influence the buyer.

Figure 2.14 displays the rate of deception for each of the five conditions. Deception is considered a binary variable and is shown a percentage of the sample on the right hand axis. Both overestimating and underestimation of the true value of the asset is considered deception. Formally, deceptive actions are frequent (this occurred when the seller in a negotiation sent information to the buyer that did not explicitly equal the actual value of their asset). Of the 155 participants who choose to learn the true value of their boxes 55 (35.4%) truthfully disclosed the value of their asset.

Figure 2.14 True Seller Value & Rate of Deception



The rates of deception are highest in treatment one (perfect asset) and condition five (worthless asset). Whilst the deception in treatment one is explained by participants underestimating the true value of the asset, treatment five solely concerns deception through overestimating.

Clues to explaining this pattern of deception are available through qualitative data gathered from participants. These explanations relate to plausibility and profit making arguments. For instance, one participant with high value boxes suggested that “4 empty boxes are *believable* (emphasis added) but will still lead to a large offer, larger than the value of the coins I have, allowing me to make a profit.” Equally, participants who held worthless assets lied for the obvious reasons that “it (the lie) would force him to pay a higher price for each box”. Participants with low valued assets also engaged in deception due to plausibility reasons. One participant with a worthless asset said that “he [the buyer] wouldn't believe that I had 0 empty

boxes, and when I had 10 empty boxes I was bluffing with a *believable* (emphasis added) amount because there's nothing to lose.”

### **2.8.7 Discussion & Conclusion – Experiment II**

In this experiment only 22% of the sample followed the predictions of normative theory by adopting information avoiding strategies. As the majority of the literature on the AAC game considers the sub-optimal decision of buyers, the evidence in this experiment shows that sellers can make similar suboptimal decisions too when their task is cognitively complex (and they must consider contingencies). 22 trades are successfully completed when sellers choose not to learn the true value of their assets, 13 of which produced positive gains for the buyer. While the distribution of gains favoured the buyer, adopting strategies to avoid additional information produced welfare enhancing trades.

Most AAC game research features rational sellers who have an easy decision to accept or reject an offer. The experiment here is based on a rational buyer when the computationally challenging task is switched to the seller’s side. The imposition causes sellers to also make naïve decisions (discounting the fact that they learn the value as they hope buyers will not realise the implications). While a significant body of evidence points towards irrational buyers in bilateral bargains, the evidence presented here supports that idea that sellers exhibit similar tendencies when contingencies exist.

Interestingly, sellers opt to engage in more deceptive behaviour when their assets are either worthless (overvaluing) or perfect (undervaluing). The fact that the sellers adopt sophisticated cheap talk strategies and believe that these message would

influence a buyer add further credence to the argument that sellers fail to appreciate the hazards associated with learning the true value of their asset.

A natural question that arises is to ask if those that remained uninformed did so by chance or foresight? Qualitative evidence supports the former idea. Those that choose less information did not suggest that the contingency as a motivation for this choice. The rationale for not choosing additional information did not relate to foresight and fell into three broad categories; fairness concerns, emotional worries (unnerve the opponent, increased thrill), and indifference, as the ultimate value would remain the same. Three participants provided 'the right reasons' for rejecting additional information. These individuals understood that the buyer's bid is intrinsically linked to this decision.

Much ink has been spilled arguing that buyers pursue naïve bidding strategies when deciding under uncertainty in bilateral bargains. The other side of the coin remains surprisingly underdeveloped. This small-scale experiment encourages more work specifically on the sellers' side of bargains under (a)symmetric information. There are several directions for future research in this area; firstly, there is a question of learning, do sellers learn to reject additional information in multiple rounds of this game. If so, how does this compare to buyer learning speeds in the traditional version of the AAC game? Secondly, as impasse in such games happens to a lesser extent in face-to-face negotiations sellers may be more likely to adjust their behaviour in these contexts. The idea of addressing face-to-face bargaining (from the perspective of the seller) is an avenue for future research, particularly as this medium of interaction is an important predictor of cooperation rates (Sally, 1995). Finally, in the experiment there are strict assumptions governing buyer behaviour and no costs associated with acquiring additional information for the seller. Altering these

parameters would likely lead to different results. For instance, if costs are imposed on sellers to build an asymmetry over a buyer, participants may reevaluate the benefits of additional information.

Whereas buyers generally fail to focus on the decision rules of informed sellers in the AAC game, sellers also generally fail to foresee the perils of additional information, exhibiting a difficulty to perform contingent reasoning on future events. Only 22% of the sample could follow a normative strategy and trade occurred in only twenty-two bargains. 78% of the sample followed a naïve strategy and choose to learn the value of their asset, thereby entering an asymmetric information negotiation setting (AAC game) with the buyer. This temptation to learn the true value on the part of sellers is tantamount to opening ‘Pandora’s box’. The seller’s action to gain additional information leads an unforeseen challenge, ultimately leaving them cursed.

Given the structure of the AAC game, sellers are cursed by opting for more information and thereby electing not to share any risk with a buyer. Logically, welfare enhancing agreements are restricted with additional information. It is likely that sellers are not even aware of this curse; there is no evidence of a significantly lower level SRQA for those that do gain extra knowledge and those that learn the true value of their asset frequently adopt sophisticated strategies to deceive their uninformed counterpart in the trade. They commonly believed that their message would influence a buyer’s bidding strategy. These results can serve to connect insights from the AAC game with the adverse selection literature.

### **3. ESSAY TWO - WINNER ALRIGHT? HIGH-STAKES BIDDING AND RETURNS TO OWNERSHIP IN THE UK AND IRISH THOROUGHBRED HORSERACING INDUSTRY**

#### **3.1 Introduction**

This essay conducts an ex-post productivity evaluation of 1,681 thoroughbred foals sold between 2007 and 2008 in UK and Irish public auctions. Doing so is advantageous as this domain offers a novel opportunity to study competitive bidding at high-stakes. Not only is a substantial volume of data available on thoroughbred auctions but, in particular, the dominant statistic of a thoroughbred's lifetime winnings provides a precise measure to monetise each asset's output. This allows one to determine the productivity of these assets ex-post (Smith, Staniar & Splan, 2006; Langlois & Blouin, 2007).

The advantages of studying thoroughbred auctions go beyond the non-trivial sums committed or measurement considerations. As thoroughbred sales are recurring competitive events, one would expect this auction environment to be populated with bidding agents who have ample opportunity to learn. Furthermore, the informational features on offer are rarely, if ever, represented in other naturally occurring auctions - foal auctions provide restricted informational conditions that can approximate laboratory environments. Given each asset's infantile status, there are minimal disparities in information across potential buyers. No knowledge of their training or earnings potential is available at the time of sale to a bidder at auction as foals are usually only 'broken in' as yearlings (a process known as halter-breaking). Thus, the potential for information differences between buyers is significantly reduced when compared to yearling markets where information leakages can occur. If sellers have additional and valuable information later in a thoroughbred's lifecycle (for instance, knowledge relating to medical history, physical attributes or psychological profile),

adverse selection problems can emerge (Chezum & Wimmer, 1997). In the case of this study, at the time of auction all potential buyers only have access to a foal's pedigree and past veterinary reports. Thus, foal auctions offer a clean but naturally occurring information structure. For these reasons, this market offers a fitting naturalistic environment to study bidding behaviour from the perspective of behavioural economics.

Although few studies have considered this auction context, fewer still have evaluated the returns to the assets sold or considered alternative economic and psychological explanations for the patterns observed. Besides analysing thoroughbreds from their earliest sales point, this essay offers two further steps forward. The first is methodological; the sample evaluated is not restricted by thoroughbred bloodline or gender and data are accessed on environmental characteristics such as trainer specific characteristics. Additionally, I access data on thoroughbreds that are sold but do not appear on the racetrack. This sampling strategy offers a clearer picture of the industry's operations. Secondly, the dataset facilitates a basic exploration of two behavioural arguments proposed to explain the net returns. Neither principle-agent problems arising between owners and trainers or diversification strategies adopted by owners have been empirically explored as route to explain returns in horseracing.

A unique feature of this study is that it concentrates on the horseracing industry in the British Isles. While the basic sporting operations of thoroughbred horseracing are alike on either side of the Atlantic, the traditions and institutional features of the industry have evolved differently. To date, this topic has been studied in the context of American thoroughbred horseracing only and, as is understood, a detailed assessment of bidding efficiencies has yet to be conducted for thoroughbred horseracing in the UK and Ireland. Thus, the findings presented here offer a basis for



comparison and can provide a practical guide for those developing bidding strategies within the industry.

The results provide empirical weight to a commonly held belief - a high percentage of thoroughbreds sold at auction incur net negative returns. The scale of losses is amplified as winning auction bids increase. Once winning bids exceed approximately €20,000, on average, losses are incurred on these assets. Taking bidding power as a measure of an owner's status suggests that absolute risk aversion decreases with wealth. The results reported here can inform a wider debate relating to the motivations of owners.

The next section offers a comprehensible guide on the workings of the industry in Ireland and the UK, focusing on the means of purchasing thoroughbreds and their maturation process. Section 3.3 provides a brief background to the few studies of this topic. Section 3.4 introduces the empirical framework, specifying the auction details and productivity data. Section 3.5 conducts an analysis of ex-post returns. Two previously unexplored behavioural explanations for the observed results are addressed at the end of this section. Section 3.6 briefly offers two possible explanations for the observed patterns. Section 3.7 concludes the essay and offers suggestions for future research in light of the findings and limitations of the study.

### **3.2 A Primer on the UK & Irish Thoroughbred Industry**

There are multiple ways to purchase a thoroughbred racehorse in the UK and Ireland. Thoroughbreds can be acquired through (i) a claiming race - where all horses running are for sale, (ii) leasing agreements - where there is no commitment required from the buyer to purchase the asset, (iii) through a private purchase - where a buyer negotiates a price and is sold the asset directly from a stud farm, breeder or trainer

and finally, (iv) through an auction. These auctions constitute the most common sales mechanism and are usually organised by the age of the animal for sale and, in the case of foals, occur late in the calendar year.

Importantly, a limited but equal information set is available to all interested parties. For buyers, decision making is commonly directed by the heritage of the thoroughbred. While heritable traits act as important indicators to buyers, genetic evidence suggests that approximately only 35% of the variation in a thoroughbred's performance is attributed to genetic lineage (Gaffney & Cunningham, 1988). The Irish Horseracing body publicly discloses this inherent uncertainty to potential buyers, suggesting that the attribution to genetics can even be as low as 9% (Horse Racing Ireland, 2009 P.32). Therefore, regardless of quality of a thoroughbred's genes, there is no guarantee of success based on breeding characteristics alone.

Initially, auction companies list each foal in internationally published catalogues approximately one month prior to an auction. These catalogues provide access to each foal's pedigree, veterinary reports, date of birth and the performance data of their relatives on the racetrack. Therefore, during an auction all potential buyers only have access to this information. Potential buyers are also permitted to vet the foal before it enters the sales ring. This allows buyers to subjectively evaluate the conformation of a foal, in addition to assessing its bone structure, movements and other factors that allow necessary due diligence. Buyers may also assess a foal for psychological characteristics such as temperament.

The auctions for foals considered here are conducted in the format of an *English* auction where the highest current bid assumes the position of the standing bid. In this format, the signal (bid) of every interested party is known during the auction. By

dropping out one is disclosing their maximum valuation of the asset for sale.

Owners who win an auction can be individuals, partnerships (which consist of between two and four people) and syndicates (which consist of up to twenty members).

All foals are registered with the same birth date (1<sup>st</sup> of January). This allows organisers to group thoroughbreds into races and to follow bloodlines. The animals range in weight from approximately 31.8kg to 65.5kg at birth. They are suckled by their dam, in most cases for six months, grow quickly and reach 90% of their adult size by the time they are two years old (Horse Racing Ireland, 2009). Thus, by the age of two, far more information is known about the potential quality of the thoroughbred. The thoroughbreds are 'broken-in' (usually as yearlings). This is an initial step in their preparation to race and compete for prize money. Later, they are prepared for racing by a trainer. The training process usually involves detailed attention to the thoroughbred's dietary requirements and exercise routines.

The winning bidder at auction is not permitted to race their asset until it is two years' old. Once a thoroughbred reaches two years of age (and is appropriately trained) they are eligible to enter races where there is an opportunity to earn significant prize money to recoup the initial purchase price. Given the distribution of racing talent, thoroughbreds are grouped into similar racing classes to safeguard competitive balance. The best thoroughbreds are those that win the highest amount of prize money, often by performing in lucrative races known as the *Classics* such as the *1,000 Guineas Stakes*, the *Epsom Derby* and the *St. Leger Stakes*. In addition to this, other *Group 1* races offer substantial prize money to successful entrants. For example, the winner of the *Epsom Derby* earns approximately £850,000. In the majority of races, prize money is offered in a descending scale from the first horse to

placed horses that finish second or third in a race. On occasion prize money is offered to entrants ranked lower. In general, an inverse relationship exists between the class of race and the prize money on offer.

Depending on the ability of the thoroughbred they can have alternative career lengths and can run in different types of races. Generally, thoroughbreds that are recognised for their speed participate in more lucrative 'flat' races. That is in contrast to national hunt horses that participate in slower and longer races over hurdles and fences. Flat horses usually begin their career at two, with some of the most lucrative races taking place when they are three. These flat horses commonly peak between the ages of four and five and can retire as young as four years old. Flat races are the primary focus of this essay.

Thoroughbreds that are not recognised for their speed often participate in national hunt races, which involves thoroughbreds jumping hurdles and fences. National hunt thoroughbreds usually begin a career at a mature stage, usually about four years old. These thoroughbreds have longer careers than flat horses and, in some cases, can race up to the age of thirteen. They generally peak between approximately seven and eight years old.

Given the distribution of prize money attached to particular races, long careers do not necessarily lead to a greater probability of high earnings; often elite horses must be selective about the races they enter. Trainers and owners may act strategically, attempting to maximise a thoroughbred's return while minimising the likelihood of fatigue or injury. Once their career is complete, elite horses commonly retire to stud to breed future offspring.

### **3.3 Background**

While past research has explored pricing models for thoroughbreds (Parson & Smith, 2008; Robert & Stowe, 2016) sire stud fees (Stowe 2013) and the impact of disclosures on pricing (Plant & Stowe, 2013), analyses of bidding efficiencies and adverse selection effects have been rare and are restricted to the American thoroughbred industry (Chezum & Wimmer, 1997; Wimmer & Chezum, 2003). A series of contributions and replies at the turn of the century offer the only analysis of the topic to date (Gamrat & Sauer, 2000; Ray, 2001; Gamrat & Sauer, 2001; DeGennaro, 2003).

Gamrat and Sauer (2000) initiated a discussion of returns to thoroughbred investment by revealing that owners pay a greater sum for an asset than its expected present value of cash flows. Less than half of their sample of 805 fillies recoup their initial cost. While this is a behavioural trait which a rational investor interested in maximising returns should avoid, the authors interpret the difference between mean returns and auction price as a measure of the non-pecuniary utility of ownership. They propose that a participation premium model to enter the sport is supported by the data (Gamrat & Sauer, 2000). This is in contrast to a pure championship model, where one would assume a causal relationship between the fee paid for a thoroughbred and probability of success on the track.

The insights of Gamrat and Sauer (2000) were subject to discussion, particularly in terms of their sampling strategy. The data accessed is restricted to a sample of fillies only and did not take account of environmental factors relating to performance (Ray, 2001). Further comment on Gamrat and Sauer (2000) is provided by DeGennaro (2003). In short, DeGennaro (2003) suggested that a non-linear relationship may exist between the distribution of thoroughbred prices and the expected returns of a

horse. In turn, this poses challenges to distinguishing between a championship model and a participation model; as the distribution of talent is highly skewed, few thoroughbreds sold at auction will become elite horses. To date, no additional data has been provided on this topic. While this essay does not attempt to solve the challenging problem posed by DeGennaro (2003), several of the sampling issues raised by Ray (2001) are addressed here, in particular I collect data across thoroughbred gender.

### **3.4 Empirical Framework**

The empirical section of this essay focusses on the net returns of foals auctioned between 2007 and 2008. Information on the thoroughbreds is captured at two points in time. Firstly, when an auction sale took place and secondly when a thoroughbred's flat career concluded.

The monetary returns of each asset, that is their net profit or loss, are treated as the dependent variable. As opposed to win ratios, the net returns of a thoroughbred adjust for the quality of races entered. As one cannot simply model how a buyer will form expectations about a foal at time of sale, evaluating the ex-post productivity of the asset at time period two is the most logical manner to proceed. Fundamentally, this method is a 'first-pass' test of efficiency (Burger & Walters, 2008).

#### **3.4.1 Auction Procedures & Data**

The dataset for this study is assembled manually through online resources. Data are accessed for foal sales from four auctions in Ireland (two) and England (two) between 2007 and 2008. These dates are chosen as in the majority of cases foals sold at these auctions had completed their careers by the end of the 2015 racing season.

The data for these auctions are accessed from the Racing Post Bloodstock Sales Database. Table 3.1 summarises the key details of the auctions.

The two auction houses that organised the sales are Goffs and Tattersalls. All auctions occurred over a five-day period and followed an ascending bid or English auction format. At the time of bidding all potential owners were assumed to be aware of the possible rewards available to these foals once they have matured. Owners in Western Europe have their own interest group (AIRO) which was established to protect these financial interests. The group has specific goals that include maintaining and increasing prize money in races.

**Table 3.1 Auction Details**

<b>Date</b>	<b>Auction House</b>	<b>Lots</b>	<b>Withdrawn</b>	<b>Sales</b>	<b>Unregistered</b>	<b>Removed</b>	<b>N</b>
17-21 Nov 2008	Goffs	1253	750	503	136	60	307
25-29 Nov 2008	Tattersalls	1251	688	563	123	51	389
18-22 Nov 2007	Goffs	1270	603	667	189	48	430
27 Nov-1 Dec 2007	Tattersalls	1390	597	793	190	48	555

Source: *Racing Post Bloodstock Sales Database*

The clearance rates for the four auctions ranged from 40.1% to 57.1%. For each auction a high percentage of total lots are either withdrawn or not sold. This regularly occurs as a foal may fail to reach a reserve price. From the remaining sales, a proportion of foals auctioned are unregistered. These are not named at the time of sale and could not be identified. Additionally, a proportion of lots sold are removed for one of two reasons. Firstly, an observation is removed if a thoroughbred's career had not concluded as their total productivity is only subject to partial measurement. The most common reason for a thoroughbred not to have finished their career was

that they not only entered flat races but also competed in National Hunt horseracing. Thoroughbreds that have a dual registration normally compete for a longer time period than horses that solely run in flat races. National Hunt thoroughbreds can race until the age of twelve or older in some cases. Secondly, observations are removed if there is incomplete information concerning the thoroughbred's earnings over the course of their career<sup>27</sup>. All foals that remained in the sample concluded their careers between 9<sup>th</sup> October 2009 and 23<sup>rd</sup> of September 2015.

Information is available on the characteristics of 1,681 individual lots. Specific physical information is collected on each of the foals such as their colour (Black 73%, Chestnut 19%, Grey 5% Brown 3%), sex (62.6% Colts; 37.4% Fillies), and relations (205 Sires, 1580 Dams). In addition, information regarding the specific lot is recorded; data are available on each foal's breeder (1062), sales vendor (567), new owner (1102) and future trainer (665). 31 owners are recorded as syndicates (which consist of up to twenty members). Importantly, the winning auction bid for each foal is recorded. All winning bids are converted to euros and historical exchange rates are used to standardise the values<sup>28</sup>. Figure 3.1 displays the distribution of winning bids in ascending order. The average winning bid is €42,047.52 (SD = €58,631.31). The lowest winning bid is €991.03 while the highest winning bid is €655,192.10.

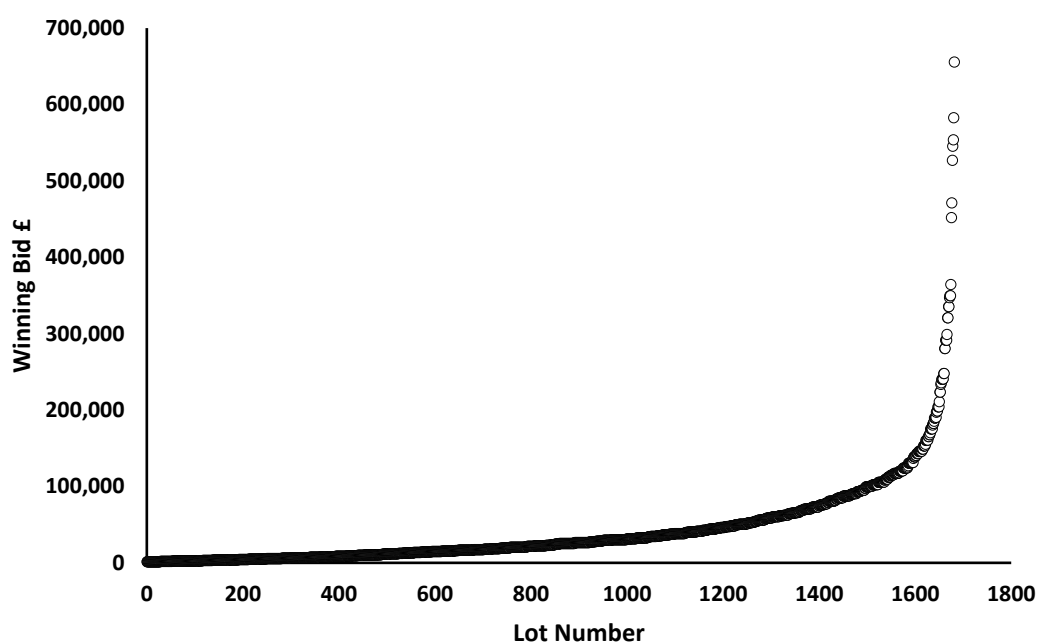
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<sup>26</sup> For instance, thoroughbreds may enter races in countries outside of Ireland and UK where no earnings data was accessible.

<sup>27</sup> Bids in English foal auctions are occasionally made in Guineas. These bids are converted to pounds sterling, and subsequently Euros, at the given exchange rates for the dates of the auction. A guinea was historically equal to one pound and one shilling (£1.05). Sales companies still use guineas, although most have switched to pounds.



**Figure 3.1 The Distribution of Winning Auction Bids in Ascending Order**



### 3.4.2 Productivity Data

The productivity measure of lifetime earnings for each lot is accessed from the Irish Racing database. Irish Racing is a website owned by The Irish Times Ltd and provides comprehensive statistics on Irish, British and major international horseracing. In addition, data are collected on each lot's number of starts during their career, number of wins, place finishes (2<sup>nd</sup>-3<sup>rd</sup>) and career length in days. Table 3.2 provides descriptive statistics for the thoroughbreds.

**Table 3.2 Productivity Details**

<b>Productivity 2007-2015 (n=1,681)</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
Starts	12.75	13.62	0	83
Wins	1.37	2.06	0	13
Places	2.60	3.64	0	22
Career Length (Days Active)	25	579	0	2346

Source: *Irish Racing*

The minimum activity for any lot is zero. This occurred if a horse only had one race in their career. Thus, a racehorse's career start and end occurred at the same point in time. This is true for one hundred and forty-two lots in the sample. Thirty-seven lots (2%) of the sample, despite being successfully auctioned, never became active or had the opportunity to produce a return. This outcome is not surprising however and is indicative of the challenging process of preparing foals to race.

### **3.5 Analysis**

This section begins by providing a descriptive account of the net returns at an aggregate level and details the asset's returns along alternative dimensions such as the gender and bidding range. Following this, two regression models that account for the distribution of the data are estimated to explore the determinants of net returns. Finally, alternative behavioural explanations that can be controlled for are given due consideration.

#### **3.5.1 Average Returns**

Table 3.3 considers the average returns of the entire sample of auctioned thoroughbreds and gender specific subsamples. Consistent with Gamrat and Sauer (2000), on average, the net returns for the sample are negative. While fillies do incur greater losses than colts, the monetary differences are not substantial. The median net losses observed for the entire sample are -€14,375.15. For the colt sample and filly sample these net losses are -€14,763.78 and -€13,855.44 respectively. It is of note that these statistics abstract from any returns generated by insider information in the betting market, something which cannot be measured.

**Table 3.3 Ex-Post Analysis**

<b>Ex-Post Efficiency Evaluation</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
Winning Bid (N = 1,681)	€ 42,047.52	€ 58,631.31	€ 991.03	€ 655,192.10
Lifetime Winnings (N = 1,681)	€ 18,337.91	€ 68,328.62	€ 0.00	€ 1,206,376.00
Net Returns	<b>-€ 23,709.61</b>	€ 85,967.64	<b>-€ 655,192.10</b>	€ 1,191,376.00
Winning Bid Colt (N = 1,053)	€ 44,248.27	€ 61,757.08	€ 991.03	€ 655,192.10
Lifetime Winnings Colt (N = 1,053)	€ 22,149.20	€ 76,560.23	€ 0.00	€ 1,206,376.00
Net Returns	<b>-€ 22,099.07</b>	€ 94,707.53	<b>-€ 655,192.10</b>	€ 1,191,376.00
Winning Bid Filly (N = 628)	€ 38,357.42	€ 52,820.09	€ 991.03	€ 545,067.60
Lifetime Winnings Filly (N = 628)	€ 11,947.33	€ 51,086.77	€ 0.00	€ 1,004,890.00
Net Returns	<b>-€ 26,410.09</b>	€ 68,855.84	<b>-€ 545,067.60</b>	€ 902,971.10

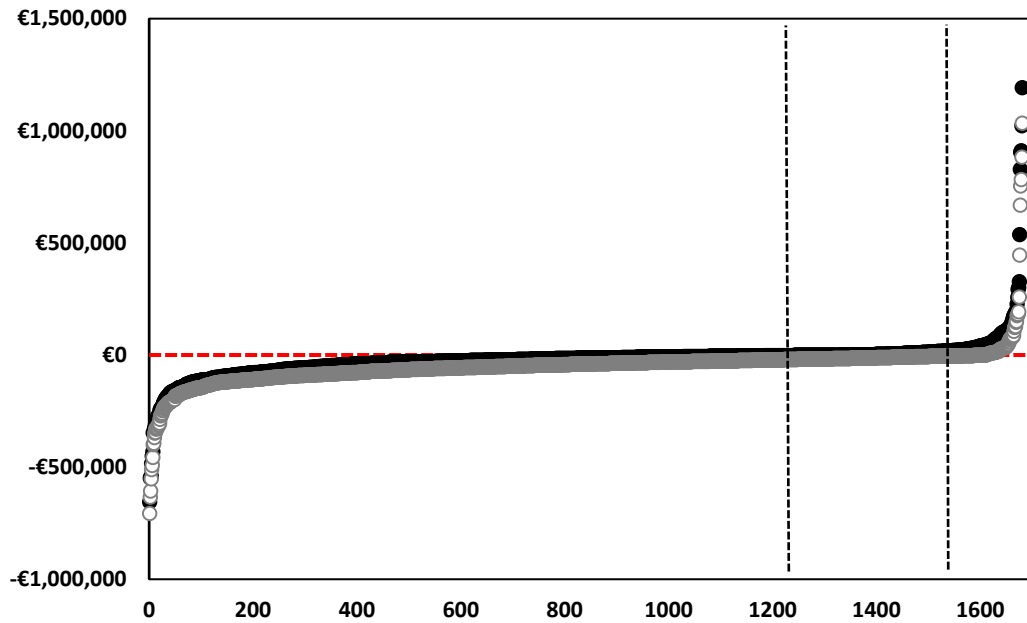
Source: *Irish Racing*

Figure 3.2 presents the unconditional net returns (indicated in black) and the restricted net returns (indicated in grey) in ascending order for the 1,681 lots in the sample. The unconditional net returns represent a straightforward analysis contingent on winning auction bids and returns. The restricted net returns measure controls for two further cost-side factors; (i) the annual average cost of a thoroughbred's upkeep which is estimated at €15,200 per annum by AIRO, adjusted for each thoroughbred's career length, and (ii) costs associated with commissions and jockey bonus fees, estimated to reduce reported earnings by approximately 10% (Gamrat & Sauer, 2000).

For the unconditional measure, the frequency of negative returns across auctions ranges from 74.4% of the sample (Goffs 2008 auction) to 83.9% (Tattersalls 2007 auction). For the complete sample 1,342 thoroughbreds (79.8%) realised negative returns and concluded their career in the domain of losses. 339 thoroughbreds (20.2%) returned a profit. Adopting the second criterion, which is sensitive to further cost-side information, deflates returns further. 1,610 thoroughbreds (95.7%) realised negative returns and concluded their career in the domain of losses. 71 thoroughbreds (4.3%) returned a profit. As the returns estimated from the restricted sample are derived from

relatively unsophisticated measures, the forthcoming inferential statistical assessment treats the first unconditional returns measure as the dependent variable.

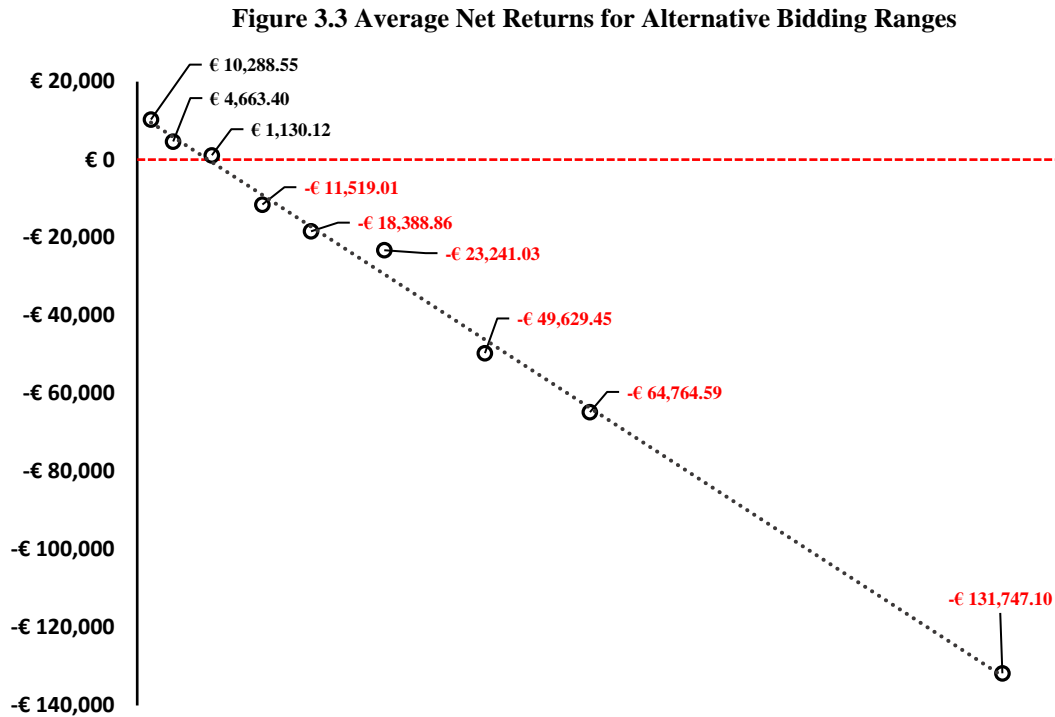
**Figure 3.2 Returns by Lots in Ascending Order**



Given the distribution of the bidding and earnings data, it is important to distinguish between alternative ranges of winning bids. To investigate this relationship Figure 3.3 represents the average returns for winning bids in nine alternative bidding ranges (€991-€4,999; n=249, €5,000-€9,999; n=211, €10,000-€19,999; n=307, €20,000-29,000; n=207, €30,000-39,999; n=155, €40,000-59,000; n=177, €60,000-€79,000; n=113, €80,000-€99,000; n=85, >€100,000; n=177). A monotonically decreasing relationship is observed. This phenomenon is robust to altering the parameters of the bidding ranges. Low winning bids, on average, produce net positive returns.

Increases on average in winning bids correspond to net returns entering the domain of losses after the third bidding category (approximately €20,000). Once winning bids reach this value, on average, the asset's productivity fails to recoup the initial

investment. Considering the distribution of the categories in Figure 3.3 and assuming bidding power is a measure of an owner's wealth status, the monetary distances between the categories suggests that absolute risk aversion decreases with wealth.



A one-way ANOVA to compare the differences in alternative bidding categories reports a statistically significant difference in productivity returns between the groups ( $F=65.67$ ,  $p = 0.00$ ). Additionally, a Kruskal-Wallis test to compare mean ranks reports a statistically significant difference between the groups identified in Figure 3.3 ( $\chi^2 = 1015.59$ ,  $p = 0.00$ ). The specific differences between the bidding categories are identified in Table 3.4 along with the pairwise comparisons of means using the Bonferroni correction technique. Once bidding is greater than €100,000 negative returns are amplified. These results add further insight to the nature of bidding efficiencies in the industry. In bidding conditions with relatively low winning bids, positive returns on *average* exist. No statistically significant

correlations are observed between lower bidding ranges, where positive returns on average are recorded.

**Table 3.4 Pairwise Correlations of Bidding Categories**

Pairwise Correlations	Bidding Group								
	1	2	3	4	5	6	7	8	9
€991-€4,999 (n=249)	-								
€5,000-€9,999 (n=211)	1.00	-							
€10,000-€19,999 (n=307)	1.00	1.00	-						
€20,000-29,000 (n=207)	0.07	1.00	1.00	-					
€30,000-39,999 (n=155)	0.07	0.14	0.31	1.00	-				
€40,000-59,000 (n=177)	0.00***	0.01**	0.021**	1.00	1.00	-			
€60,000-€79,000 (n=113)	0.00***	0.00***	0.00***	0.01***	0.03**	0.13	-		
€80,000-€99,000 (n =85)	0.00***	0.00***	0.00***	0.00***	0.00***	0.01***	1.00	-	
>€100,000 (n =177)	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	-
Statistical significance: ***1% level; **5% level									

### 3.5.2 Regression Analysis

This section estimates a basic model to evaluate the important factors associated with each asset's net returns such as winning bids (Winning Bid), a vector of performance statistics and further qualitative controls. Although the model specified represents a relatively parsimonious returns equation, it expresses the important characteristics associated with returns that are accessible. An assumption of this analysis is that given the publicly available information on pedigree prior to the auctions, any genetic factors relating to potential performance are fully incorporated into the bids.

Given the skewness of net returns, estimating the relationship between net returns and a series of covariates with a least squares approach will likely produce inefficient estimates. Normality tests investigating skewness (Skewness - 3.931, Pr(Skewness) - 0.000) and kurtosis (Kurtosis - 67.420, Pr(Kurtosis) - 0.000) reject normality assumptions. In addition, the joint test indicates the non-normality of the dependent variable ( $\chi^2(2) = 1015.59$ , Prob >  $\chi^2$  - 0.000). To allay these concerns two alternative estimation procedures are adopted. Firstly, a Huber (robust) regression is estimated using M-estimation. Unlike OLS, the robust regression is not as susceptible to non-normally distributed observations and, importantly, is not sensitive to outliers. In particular, the Huber estimates provides distributional robustness, as large deviations will not weaken the efficiency of the results. This robustness is achieved by penalising small residuals quadratically and greater residuals linearly. These estimates provide a benchmark to compare a second procedure; the quantile regression. This method was introduced by Koenker and Machado (1999) and is becoming an increasingly powerful research tool, offering a valuable alternative to the least squares approach. The primary advantage of the quantile regression approach is that it allows for a richer understanding of the



dataset. While OLS point estimates only provide a partial view, the quantile regression characterises the entire empirical distribution. As opposed to defining average relationships between the net returns and the covariates, the quantile regression allows one to understand fractional relationships across quantiles where the 50th percentile represents the median ( $T=0.5$ ). Essentially, these are non-central points. Akin to the Huber regression, the quantile (median) regression is robust to outliers than least squares. Apart from gaining a more detailed understanding of variations within the dataset, this procedure is also not restricted in its assumptions regarding the distribution of the error term. Bootstrapped standard errors are included for the quantile regression estimates<sup>29</sup>.

Regarding the model specification, let  $NETR_i$  represent a thoroughbred's net returns and  $x_i$  a vector of explanatory variables on bidding information and performance. For the Huber (robust) regression the major difference is the absence of any analysis of a restricted distribution. The quantile approach requires that the inclusion of  $T$ th quantile of the restricted distribution of  $NETR_i$  is a linear function of the covariates  $x$ . The constant term is denoted by  $\alpha(T)$  and  $\beta(T)$  represents a vector of unidentified parameters to be obtained.  $u_{Ti}$  represents the error term which is unknown. No distributional assumptions are made about  $u_{Ti}$ .

$$NETR_i = \alpha(T) + \beta(T)x_i + u_{Ti}$$

As the explanatory power of parameters  $\beta(T)$  is contingent on which quantile is estimated, the effects (as seen in the results in Table 3.5) on  $NETR_i$  can vary across the distribution. In a nutshell, this is a primary advantage of this technique; the

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<sup>28</sup> This is analogous to robust standard errors in the linear approach. Essentially, the assumption of independent errors is retained and the assumption of identically distributed errors is relaxed.

results from alternative quantile estimates are interpreted with respect solely to that portion of the distribution. It is of note that log-linear approaches to modelling the dependent variable can be adopted; while this may decrease the skewness in the dependent variable, there is a cost. Namely, key characteristics of the returns distribution are overlooked.

To control for the influence of environmental factors such as training and access to elite jockeys thoroughbreds are categorised into one of two stable grades. Elite stables are considered trainers in the top twenty total earners for the years of the dataset (Horse Racing Ireland, 2015). Sixteen stables fulfil this criterion and are classified as elite (Elite Stable). These stables are deemed to provide thoroughbreds' access to leading training methods, facilities and riding skills. One hundred and twenty observations thoroughbreds are classified as elite. Consistent with the entire sample, thoroughbreds trained by elite stables, which potentially provide a clearer picture of owner's seeking a championship horse, return average net losses of €24,662.63 (SD = €158,887.8).

Regarding the vector of performance information, explanatory variables are incorporated to explain each thoroughbred's returns, including the ratio of their number of starts (Wins and Places), how many days a thoroughbred is active for (Career Length) and additional dichotomous variables for a thoroughbred's gender (Sex) and the auction house that processed the foal's sale (Company). Given that a thoroughbred's coat colours do not relate to racing performance this information is not included in the analysis (Stachurska, Pięta, Łojek & Szulowska, 2007). Table 3.5 displays the results from both procedures. The pseudo  $R^2$  provides a local measure of fit for the quantile regression.

**Table 3.5 Determinants of Net Returns: Huber (Robust) & Quantile Regression Estimates**

DV: Net Returns	Huber Regression		Quantile Regression	
Covariates	Estimates	( $\tau = 0.25$ )	( $\tau = 0.50$ )	( $\tau = 0.75$ )
Company	228.51 (118.3010)	173.74 (131.188)	193.73 (262.347)	116.63 (159.68)
Sex	-114.059 (123.213)	-116.587 (74.873)	-584.786 (256.292)	-77.65 (122.470)
Winning Bid	-0.999*** (0.001)	-0.999*** (0.0017)	-0.999*** (0.0026)	-0.9961*** (0.0017)
Elite Stable	725.446** (227.023)	534.4401** (180.880)	1171.446*** (321.566)	505.425 (338.752)
Wins %	38302.43*** (475.36)	26581.71*** (2701.805)	53015.98*** (7628.243)	124441.5*** (20550.5)
Place %	4319.249*** (328.54)	4077.625*** (507.12)	3388.331*** (738.286)	1750.635*** (648.7)
Career Length	2.181*** (0.104)	2.567*** (.008)	7.255*** (1.142)	12.891*** 1.808
Constant	-466.903** (131.941)	-942.99*** (258.845)	-1072.722*** (131.941)	-528.537*** (136.9707)
Pseudo R <sup>2</sup>	-	.78	.62	.43

Significance level: 1%:\*\*\*;5%:\*\*  
Robust Standard Errors (RSE) in parentheses

The results of both estimations show a statistically significant negative relationship between increases in winning bids and net returns (for all of the conditional quantiles). Using the log transformations of the dependent variable and winning bids produces almost identical results to those presented in Table 3.5. Higher winning bids are associated with lower net returns to owners. Notably, the quantile regression reports that this relationship is stable across the distribution.

As expected, a thoroughbred's career wins have explanatory power and are positively correlated with net returns in both models. Finishing in a placed position is also expectedly positive and statistically significant. Environmental factors such as a thoroughbred's sale company or sex do not statistically influence their return. Although the magnitude of the effect is small, career length remains statistically significant for both models (and across quantiles). It is noteworthy that the quantile regression reports that the only statistical differences in environmental factors influencing returns across the distribution occurs for thoroughbreds producing negative returns; access to elite stables for these thoroughbreds can reduce their losses.

### **3.5.3 Alternative Behavioural Explanations**

The thoroughbred horseracing industry is complex and involves multiple interacting parties. While the non-pecuniary motivations interpretation of the inefficiencies provided by Gamrat and Sauer (2000) offers a plausible explanation for this data, more rational interpretations may exist.

A first explanation for significant losses could appeal to the misaligned incentives that arise between owners (principals) and trainers (agents). From the data collected it is possible to control for moral hazard that could emerge from misaligned

incentives. One can identify the returns of thoroughbreds that are owned and trained by the same individual (incentive-compatible condition) compared to the rest of the sample (moral hazard condition). 228 sales occurred where the trainer held full ownership over the foal, had a stake in its ownership, or the owner is directly related (through family name) to the trainer. In these circumstances, one could assume that the trainer had a greater interest in ensuring a thoroughbred performed to the best of its ability. The net returns for both the moral hazard and incentive-compatible conditions are negative. Interestingly, losses are greater for thoroughbreds in the incentive-compatible condition. The average net losses for thoroughbreds owned and trained by the same party are -€31,045 and -€22,492 in the moral hazard subsample. This finding suggests that traditional principle-agent dynamics are not an influencing factor on net returns. On the contrary, trainers, with future incomes in mind, may pay more attention to horses they do not have a stake in.

Equally, owners that also trained thoroughbreds show a tendency to have similar bidding strategies; no distinct differences exist between the maximum amount training owners and non-training owners are willing to bid to win an auction. As a corollary of this argument, one could argue that ownership structures defined as syndicates may earn even lower returns; increasing the size of the ownership arrangement of a thoroughbred may detach a trainer further from achieving elite performance. There is no evidence to suggest that syndicates return disproportionately greater losses. The 31 owners classified as syndicates returned average losses of -€26,571.63.

A second explanation to account for the losses could appeal to owners adopting a diversification strategy when purchasing foals. Fully aware that some will return losses, owners could be confident that high profits from one successful thoroughbred

will insure the losses of others. Similar to the moral hazard argument, the dataset facilitates an empirical examination of this reasoning. Table 3.6 displays the eighteen owners in the dataset who purchased five or more thoroughbreds across the four auctions. In light of the winning bids, only two of the buyers return positive earnings

**Table 3.6 Alternative Behavioural Explanations – Returns to Diversification**

Owner	No. $\geq 5$	Mean Bid	Mean Returns	Profit/Loss
Andrew Tinkler	5	€ 51,935.44	€ 35,483.38	-€ 16,452.06
Dr Marwan Koukash	10	€ 26,851.99	€ 54,890.24	€ 28,038.25
Godolphin	15	€ 93,492.38	€ 43,214.21	-€ 50,278.17
Habton Farms	5	€ 21,121.54	€ 4,620.64	-€ 16,500.89
Hamdam Al Maktoum	18	€ 111,458.32	€ 17,480.08	-€ 93,978.25
Highclere Thoroughbred Racing	6	€ 33,691.88	€ 67,841.54	€ 34,149.67
HRH Princess Haya Of Jordan	5	€ 38,757.86	€ 15,400.65	-€ 23,357.21
Jaber Abdullah	14	€ 27,356.84	€ 4,912.69	-€ 22,444.14
M Khan X2	5	€ 41,993.24	€ 7,655.13	-€ 34,338.11
Mark T Gittins	5	€ 25,226.77	€ 3,586.00	-€ 21,640.77
Michael Tabor	8	€ 213,804.10	€ 138,594.24	-€ 75,209.86
Mrs H Steel	7	€ 58,708.29	€ 27,157.26	-€ 31,551.03
Mrs J Wood	7	€ 56,681.07	€ 8,814.26	-€ 47,866.81
Mrs John Magnier	6	€ 96,584.84	€ 55,969.41	-€ 40,615.43
Saeed Manana	11	€ 32,979.24	€ 8,268.37	-€ 24,710.88
Saleh Al Homaizi & Imad Al Sagar	5	€ 103,476.50	€ 709.18	-€ 102,767.32
Sheikh Ahmed Al Maktoum	18	€ 80,217.00	€ 27,435.01	-€ 52,781.99
Sheikh Majid Al Maktoum	5	€ 144,654.13	€ 30,903.35	-€ 113,750.78

Source: *Racing Post Bloodstock Sales Database & Irish Racing*

As Table 3.6 clearly reveals, no systematic evidence exists to suggest that buying multiple foals can return a profit on average. As one would expect these owners to have a detailed knowledge of the industry, the losses posted are noteworthy.

Additional ownership costs outside of the purchase price, coupled with the fact that the winning sums are not solely distributed to owners, would only serve to diminish these returns further.

### **3.6 Discussion**

Thoroughbred auctions are public contests, where non-trivial monetary sums are committed by experienced buyers. The evidence reported here confirms an intuition that the majority thoroughbreds purchased incur net negative returns. One is left questioning why such losses are accrued, particularly in light of the failure of standard economic explanations, and what are the implications of these results?

#### **3.6.1 Utility Maximisation vs. Profit Maximisation**

The first line of argument, consistent with that of Gamrat and Sauer (2000), suggests that this industry is one where the motivation of profit maximisation is questionable. If utility maximisation is the goal of owners, the extent of losses could be interpreted as a form of (conspicuous) consumption as opposed to investment or as an entry fee to participating in the sport. Akin to affluent individuals buying yachts or football clubs, thoroughbred horseracing could be viewed as another sphere where costly signalling is rampant. While it would be naïve to imply that every owner is indifferent to losses, the extent of losses has implications for the use of profit maximising models adopted to study this industry. This point is particularly relevant for owners with a greater number of purchases.

A second consumption based interpretation involves viewing the purchasing activities of owners as collector-style behaviour. This type of consumption has been given a limited amount of attention by psychologists and behavioural economists (i.e. Apostolou, 2011). Viewed in this fashion, the losses could constitute the costs involved in building a portfolio of assets which is consistent with one's perceived identity or image. The results may have implications for researchers looking for natural occurrences of this collector-style behaviour.

### 3.6.2 The Winner's Curse Hypothesis

A second line of argument which is previously unexplored relates to the potential for decision making errors to arise from the auction environment. While Ray (2001) suggests that evidence of overbidding may be due to an incorrect assessment of thoroughbred abilities, no research has considered an interaction of estimation failures and the auction mechanism as a potential cause of negative returns. The evidence presented here, while consistent with the idea of non-pecuniary motivations or some type of conspicuous consumption, is also generally consistent with a *winner's curse* hypothesis. The *winner's curse* is the systematic tendency for individuals to overbid or follow naïve bidding strategies when the true value of an asset is unknown. This has been a phenomenon subject to detailed experimental attention (Kagel & Levin 2002) and has been previously applied to other sport's labour markets (Cassing & Douglas, 1980; Burger & Walters, 2008; Massey & Thaler, 2013).

Given the uncertainty attached to a thoroughbred foal's productivity and an expected variance in bidder estimates, the possibility of a *winner's curse* may increase in likelihood in this industry. A premium associated with winning the auction may inflate losses. Although a statistically significant negative relationship is reported between increases in winning bids and net returns, as no information can be accessed on bidder characteristics this argument is evidently tentative and conjectural in nature. Despite this, the tendency for bidders to estimate an extreme value at these auctions and subsequently overbid, is a logical argument worthy of consideration. Naturally, this raises a question for future analysis if access to bidder data per auction are available.



### **3.7 Conclusion**

This essay takes advantage of the unique characteristics of thoroughbred horseracing auctions to evaluate bidding strategies under unique informational conditions. This is a setting where the ‘cost of thinking’ is high – bidders tender significant sums of money. Conducting an ex-post efficiency evaluation of thoroughbred foals, I show that a high percentage of (79.8%) sold via public auctions in Ireland and the UK incur net negative returns over their career. When foals are grouped into specific bidding categories, a monotonically decreasing relationship is observed. Once a winning bid increases above approximately €20,000, on average, the assets enter the domain of losses. This scale of losses is amplified as winning bids increase beyond this breakeven threshold. Incompatible incentives between owners and trainers and diversification strategies on behalf of owners fail to explain the level of inefficiencies observed.

When one considers the restricted estimates associated with ownership such as bonus payments, commissions, entry costs and training fee’s, there is a high level of inefficient bidding if owners are assumed to be profit maximising agents. The results show that increases in winning bids have a negative relationship with returns across alternative estimations, a result which has practical implications for those within the industry seeking to formulate optimal bidding strategies. Consistent with Gamrat and Sauer (2000), on average, thoroughbreds fail to recoup their value. While this study does not attempt to identify the alternative motivations of owners, several of the methodological improvements relating to sampling strategies are addressed.

It is important to highlight the limitations of this study. Firstly, one must be cognisant of missing information that cannot be accessed and restricts a complete measurement of returns. This study has purposely focussed on accessible valuation

and productivity information. Other than basic estimates, it is not possible to collect data on the transaction costs or management costs associated with owning thoroughbreds (e.g. training fees, commissions, entry fees and veterinary bills). These are heterogeneous expenses that will amplify negative returns and dampen positive returns. Equally, limited information is available on residual revenue streams from these assets, most importantly, a thoroughbred's stud fees. Although foals are bred for the purpose of racing, a thoroughbred could recoup their initial investment if they are selected to breed. Stud fees are often negotiated privately and are frequently undisclosed. While this is a limitation, it should be noted that only select thoroughbreds are used in stud farms; the dataset of foals accessed here are sired by just 205 colts. Hence, holding a substantial residual value is reserved for elite thoroughbreds, several of whom may have already successfully recouped their initial cost on the track.

Secondly, thoroughbred horseracing has a rich history. Bidding inefficiencies could be tapered if industry-specific informal mechanisms exist to allow bidders recoup investment. While no such informal mechanisms other than 'pinhooking' have arisen during this research, prospective work may identify subtle informal contracts, buy back arrangements or re-sale tactics<sup>30</sup>.

Finally, isolating the heterogeneous motivations of owners could serve to distinguish between different owner types and address the concerns that multiple interpretations can explain the observed pattern. Disentangling these motivations is an interesting starting point for future research.

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<sup>30</sup> A strategy of a small group of buyers is an activity referred to as 'pinhooking'. This is when investors purchase thoroughbreds solely for the purpose of resale. While individual 'pin-hookers' can earn significant profits following this strategy, this study focuses on the unconditional net returns on the assets rather than the distribution of gains and losses.

## **4. ESSAY THREE - UNRAVELLING & STRATEGIC DISCLOSURE: EVIDENCE FROM THE HOSPITALITY INDUSTRY**

### **4.1 Introduction**

Service providers, such as those in the hospitality industry, increasingly have the opportunity to publicly disclose information about the quality of their services in such a way that it reaches the widest possible number of consumers. When disclosure is possible, non-disclosure is meaningful since it can imply something about non-disclosed information. Usually this information is unfavourable because otherwise it would have been disclosed. Economists have developed theoretical accounts of what information will be disclosed, and why (Viscusi, 1978; Grossman, 1981; Milgrom, 1981; Riley, 2012). In this essay I investigate whether information is disclosed as predicted by theory and consider how to explain the results. The essay is written in the context of TripAdvisor rating disclosures from hoteliers at a regional and international level. Taking advantage of the potential to build extensive and unique datasets from online resources underpinned by electronic word-of-mouth (eWOM), I test the unravelling principle, an economic theory of disclosure. The aim of the essay is to build upon existing empirical investigations of this idea and to examine disclosure choices in a new market. Not only do I inform a wider empirical debate relating to disclosure, but as this essay focuses on tourism, the findings can provide qualitative insight for those interested in the operations of the industry.

The hospitality industry is economically significant. In the UK, it is the fourth biggest in terms of employment. In 2014 it contributed an estimated 57 billion to UK GDP (4% of total GDP) and £41 billion to the Exchequer (Oxford Economics, 2015). Despite the commercial importance and size of the sector, it has not attracted attention from researchers studying disclosure decisions. This is in contrast to the domains of health (Pope, 2009), education (Hastings & Weinstein, 2008; Luca &

Smith, 2013), housing (Carrillo, Cellini & Green, 2013) and finance (Patten, 2002; Brammer & Pavelin, 2004, Beaver, Shakespeare & Soliman, 2008). In the internet age, where an abundance of information is available on the quality of service providers, it is likely that researchers will turn their attention to consumer markets (i.e. Sah & Read, 2017a).

The hospitality industry has also been dramatically effected by eWOM. Since the establishment of TripAdvisor in 2000, the website has become the primary third party ratings agency for hotels globally. The platform now acts as a credible third party rating tool for hotels to credentialise themselves outside of the star system. As of 2017, TripAdvisor has published approximately 465 million reviews, attracting 390 million unique users. This growing influence of TripAdvisor is indicative of consumers' suspicion of internal certification and an example of trust based internet systems (Jeacle & Carter, 2011). The impact of online consumer reviews has been subject to a great deal of research (e.g. Park, & Nicolau, 2015). In the context of hotels, it has been shown that exposure to online appraisals has a considerable impact on consumer choice (Vermeulen & Seegers, 2009; Casalo, Flavian, Guinaliu, & Ekinci, 2015).

Conceptually, this essay relies upon the economic theory of disclosure and the unravelling principle. The intuition underlying the unravelling principle is the notion that an agent (such as a business) will disclose information about itself whenever it is in its interest to do so. If it does not disclose at any time it is because it judged itself better off not disclosing. How this can play out in practice gives rise to the term "unravelling". Imagine a seller who has the best possible rating of, say, 5/5. Of course that seller will reveal that quality to a buyer, assuming it is costless to do so. Given this is what a 5/5 seller will do, then a 4/5 seller will also want to disclose

since otherwise it will be confused with those having even lower ratings. The process unravels, with the 3/5 disclosing because they do not want to be perceived as having less than 3/5, and so on. Only the seller with the lowest rating will be indifferent between disclosure and non-disclosure, since by not disclosing they are revealing they have the lowest rating. In general, information on any given dimension will be revealed whenever by doing so one can avoid being pooled with agents worse than you on that dimension.

This idea, that in equilibrium all information will be revealed, is best summarised by Frank's (1988) full disclosure principle. According to Frank (1988, P.104) "if some stand to benefit by revealing a favourable value of a trait, others will be forced to disclose their less favourable values". This 'force' is imposed on sellers who go through a sequence of logical steps, all contingent on the expected response of a consumer to non-disclosure. This anticipated consumer response to non-disclosure is the most interesting behavioural feature of the principle. Namely, sophisticated reasoning requirements are imposed on the consumer, who should interpret non-disclosure with the maximum of scepticism.

Despite the straightforward intuition behind the principle there has been relatively little empirical scrutiny of the topic. In particular, researchers have had comparatively limited samples at their disposal to test the unravelling result, commonly of less than three hundred observations distributed across a quality range. Obvious reasons exist to explain the absence of studies. Historically, centralised rating systems from which to voluntarily disclose positive traits very often did not exist. Furthermore, even if such non-mandatory systems were present, there were few (if any) practical methods to verify the presence of a disclosure or if disclosable information was available (or even if the disclosure was accurate). In the absence of

a way to verify costless claims, any such messages remain unsubstantiated ‘cheap talk’ (Farrell & Rabin, 1996). Previous researchers were commonly restricted to studying markets subject to legal changes which imposed structural breaks on disclosure requirements.

Advances in both rating systems and data availability through online resources in light of the development of e-commerce has allowed for more detailed empirical research. Addressing the first limitation, online platforms offer a medium for the dissemination of non-endogenous quality ratings information for consumers. Examples include Yelp, IMDb, Angie's List, and in the context of this study, TripAdvisor and Trustpilot<sup>31</sup>. Regarding the second limitation, an online presence has become a critical route to market for many sellers. Thus, online platforms offer researchers accessible data on a seller's disclosure decision and a means to test unravelling (e.g. Luca & Smith, 2015). Disclosures of this kind, while cheap, are verifiably so.

The first major finding of this essay is that, on average, while higher ranked hotels are more likely to disclose their TripAdvisor score relative to lower ranked ones, this is not in the way unravelling theory predicts. In particular, unravelling is incomplete with many hotels with even good ratings failing to disclose. This partial unravelling result is true both regionally and internationally. An analysis of stricter subsamples, for individual locations, reveals that disclosure decisions follow similar patterns across cities but that idiosyncrasies exist between locations.

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<sup>31</sup> Both Yelp (Luca, 2011) and IMDb (Brown et al, 2012) have provided a data source to assess strategic disclosure decisions in addition to lesser known rating websites such as Charity Navigator (Yörük, 2016).

Secondly, I find that a pattern exists between the internal certification of a hotel and TripAdvisor ratings. The frequency of TripAdvisor disclosures for hotels ranked as 5-star declines when they fail to achieve a corresponding TripAdvisor score.

TripAdvisor performances that are greater than (or less than) an industry rating have higher rates of disclosure when outperforming their star rating and lower rates when underperforming. It is as if hotels believe their star-rating will be diluted if mixed with a lower TripAdvisor score, even though the two ratings are on different scales.

Thirdly, assembling three additional datasets I offer novel insights. Firstly, I access data from holiday catalogues to show higher levels of TripAdvisor revelations occur when the disclosure decision is made by a third-party (I assume hotels have an input to this decision). In contrast to hotel websites, which often rely on visual marketing to entice consumers, holiday catalogues provide a wealth of detailed text information in a somewhat standardized format where one option is usually selected from a portfolio compiled by an intermediary agent. As predicted, disclosure increases considerably in this context as non-disclosure is salient. Secondly, I access supplementary data from Trustpilot, a lesser known online platform that operates in a similar fashion to TripAdvisor. This allows one to question whether disclosure patterns are different in a market where consumers may not realise there is a rating to disclose. Theoretically, the unravelling principle applies to situations in which consumers know there is a rating, since only then can the consumer identify non-disclosure and draw any inferences. One should expect that unknown rating categories will rarely be disclosed, unless the ratings are very good. A comparison between disclosure of TripAdvisor and Trustpilot ratings therefore allow the degree of strategic thinking to be tested. If companies are thinking strategically about the response of customers, they will almost always disclose their TripAdvisor ratings,

but be cautious about disclosing their Trustpilot ratings. I find, however, there is no difference in the disclosure pattern between the two rating providers. Verifying disclosure decisions for 489 non-bank financial institutions registered with Trustpilot in the UK/Republic of Ireland and USA, I find that a similar monotonically decreasing disclosure relationship exists (as it does for TripAdvisor). This suggests that disclosure decisions are independent of anticipated consumer response to non-disclosure and consumers' expectations or access to quality information. Thirdly, we extend our primary analysis to investigate the propensity for elite hotels to countersignal. We identify the world finest hotels, accessing the Forbes Travel Guide – Star Award Winners list.

The next section places the unravelling principle and the idea of strategic disclosure within the literature by introducing related theoretical and empirical work. Section 4.3 provides a rationale for the study of disclosure based on the features of the industry. A particular emphasis is placed on the advantages of the product and markets characteristics. I underline how this industry provides a perfect setting to connect theoretical and empirical domains. Section 4.4 introduces the empirical framework, the data and procedures. The analysis and results are presented in Section 4.5. Section 4.6 introduces the first additional dataset by evaluating the importance of the choice environment. The results are explained in Section 4.7 and I explore the behavioural motivations important to non-disclosure, introducing the second supplementary dataset. Section 4.8 concludes the essay by proposing the practical implications of non-disclosure for the hospitality industry and suggests directions for future research in light of the findings.



## **4.2 Disclosure & The Unravelling Principle**

### **4.2.1 Basic Theory & Implications**

The unravelling principle is important to strategic interactions where an agent with favourable private information wishes to communicate this trait to other agents. The equilibrium prediction of the game is full disclosure on behalf of more informed parties. While the initial labelling of the term can be traced to Viscusi (1978) in the context of labour markets, the theoretical development of the unravelling equilibria was made by Grossman (1981) and Milgrom (1981) who assessed monopolist disclosure decisions when facing no disclosure costs. This was extended by Jovanovic (1982) who took into account the cost of disclosure. Further theoretical refinements include that of Farrell (1986), who recognised the costs associated with acquiring information.

As outlined, the unravelling principle should lead to complete disclosure on the part of better informed sellers. Full disclosure is appealing from a policy perspective as it can improve consumer welfare without legislation, permitting competitive behaviour to overcome problems associated with asymmetric information (Akerlof, 1970). As Dye and Finn (2007) suggest, adverse selection should not pose a problem to the operation of markets if the unravelling principle holds, so long as sellers can make credible, costless claims. Examples of the positive implications of disclosure include increased trust between buyers and sellers, improved market sorting (both horizontally and vertically), and the escalation of competitive pressures which can cause inferior firms to improve. Voluntary disclosure can allow consumers to make more informed choices and protect them from unscrupulous sellers. In sum, resources are allocated more efficiently as disclosure should alter the frequency of trade and the price structure. Dranove and Jin (2010) provide a complete review of

the effects of disclosure, expanding on many of the positive consequences suggested here, while Sah, Cain and Loewenstein (2013) provide insights into the perversions of mandatory disclosure policies.

While the unravelling principle is logically sound, the implications of the principle are behaviourally questionable. Specifically, the iterative logic is premised on sellers disclosing because they believe consumers will interpret non-disclosure in the worst possible light. The assumption that consumers will construe sins of omission in this way is debatable. A significant body of research has shown that individuals routinely fail to appreciate, and commonly underestimate, the information content of others' actions. Consumers can suffer from informational based projection biases, falling under the broad remit of bounded awareness in negotiation (Bazerman & Moore, 2009). In a negotiation context, individuals can systematically fail to see 'what is not there' (Chugh & Bazerman, 2007). Recent experimental evidence is adding greater weight to the claim that individuals fail to adjust for non-disclosure as unravelling theory would predict (Sah & Read, 2017b). This is one recent finding from many. Loewenstein, Sunstein and Golman (2014) provide a general insight to the behavioural economics of disclosure and how information disclosures relate to the law in light of a range of findings which suggest individuals are subject to biases.

#### **4.2.2 Empirical Tests of Unravelling**

A limited amount of empirical work has tested the unravelling prediction. This branch of literature is concerned with whether firms make a quality disclosure. The earliest study is by Mathios (2000) who used scanner data to study voluntary and mandatory disclosure for salad dressing in American markets after the 1990 Nutrition Labelling Act. He demonstrated a striking and linear relationship between the likelihood of disclosure and fat content. Virtually all products with under six

grams of fat per serving disclosed, 60% of those with between 7 and 9 grams of fat, and only 20% of those with between 10 and 20 grams.

The contributions of Jin and Leslie (2003) and Jin (2005) represent further tests of the unravelling prediction. Taking advantage of legal variations, Jin and Leslie (2003) studied hygiene quality regulation in Los Angeles where a disclosure decision was voluntary and mandatory for different groups. They found that restaurants mandated to disclose their hygiene ratings improved on the hygiene dimension relative to restaurants for which disclosure was voluntary. Jin (2005) studied disclosure by analysing accreditation reviews from 1991 to 1998 for Health Maintenance Organizations (HMO's). They used regression to control for important demand and cost factors associated with disclosure in the industry. Similar to Mathios (2000), the findings are contrary to the strict unravelling prediction. Interestingly, lower disclosure rates were observed in highly competitive markets, a finding which might cast doubt on the assumed relationship between competition and disclosure.

Carrillo et al (2013) investigate disclosure decisions over two periods in the context of education and housing markets in Virginia. They found that home owners selectively reveal school quality traits when selling a property. Properties located in relatively higher quality schooling districts are more likely to voluntarily disclose school quality. With time, these disclosures increase – 68% of the property listings made a school quality disclosure over the 2001-2002 period, increasing to 75% for 2006-2007.

Considering the limits of strategic inference, Brown, Camerer and Lovallo (2012) tested disclosure and non-disclosure in the entertainment industry. They analysed the

success of films that are opened with or without prescreenings for critics. Analogous to the shunning of restaurants that do not disclose hygiene scores, movie goers should rationally use the information content embedded in this decision and make the inference that studios have no confidence in films that are not prescreened and therefore they are of poor quality. Brown et al (2012) found that consumers were much more forgiving than indicated by the unravelling principle. Films that were not prescreened earned box office premiums when compared to pre-screened films of similar quality. This premium occurred only in the first week. These films showed precipitous box office drops once word of mouth spread.

The most recent empirical test of unravelling addresses the disclosure of business school ratings. Luca and Smith (2015) assess disclosure decisions for MBA programs in American educational institutes. They found that 65% of 240 business schools publish their review score. Interestingly, elite schools with very high ratings sometimes countersignal by not disclosing. Mid-ranked business schools were more likely to disclose their rating when compared to elite schools.

#### **4.3 Disclosure Decisions & The Hotel Sector**

Outside of the more palpable motivation relating to the greater quantity of data that can be accessed on the hotel sector (in comparison to earlier empirical studies), and the economic significance of the industry, there are two broad advantages of investigating the unravelling principle in this domain. These benefits can be separated into (i) appealing product-market characteristics and (ii) the fit between theoretical assumptions and the characteristics of the market.

#### **4.3.1 Product-Market Characteristics**

The hotel market is characterised by vertical product differentiation, with hotels differing greatly in quality. This is the basis for internal industry standards, embodied by the star certification system, and the emergence of review websites such as TripAdvisor. Secondly, the ability to game disclosure systems is less applicable in this sector. This is in contrast to, for instance, hospitals that can often select which patients to treat. Hotels cannot screen customers systematically. This is likely to increase the validity of user ratings. Thirdly, certain attributes of the product are appealing. Hotels have high turnover rates and therefore, as with any high frequency repeated purchase, there are many consumers available to provide ratings. Hotel visits are also repeated experience good, with most customers having experience of many hotels. Consequently, consumers can put considerable trust in the expertise or domain knowledge of TripAdvisor contributors. Finally, in contrast to many experience goods where tastes are idiosyncratic, preferences for hotels should be relatively well-behaved. Most customers prefer hygienic hotels to unhygienic ones, polite staff to discourteous ones and more leisure facilities to less. Well-behaved consumer preferences are a prerequisite for complete unravelling, and I suggest this is a reasonable assumption for the hotel market.

#### **4.3.2 Theoretical – Empirical Fit**

Firstly, a critical assumption of the unravelling principle is that traits must be costless to credibly disclose. This is a safe assumption to make for this industry given that quality disclosure merely entails a hotel incorporating TripAdvisor information on their official website. This disclosure decision is not a costly signal and is easily interpretable by consumers. Nor is it a technically challenging task to incorporate a rating. The TripAdvisor ‘bubble rating’ is a summated rating offered as

a summary measure of quality on an ordinal scale ranging from 1 to 5 where half unit scores are possible. The scoring system corresponds to Excellent (5), Very Good (4), Average (3), Poor (2) and Terrible (1)<sup>32</sup>. The ease with which this information can be interpreted increases its effectiveness in altering consumers' opinions (Sparks & Browning, 2011).

Secondly, purchasing a hotel stay often involves travel to a location where guests have limited local knowledge concerning quality, and so one can assume buyers do not have complete information regarding their purchase *ex ante*<sup>33</sup>. A perfect information environment does not exist. While it is possible that guests can access quality information on TripAdvisor, assumedly known by hotels, they may not opt to acquire this information. Assuming all hotels are aware of their performance on the TripAdvisor platform, the best quality hotels should seek to signal their quality.

#### **4.4 Empirical Framework**

To investigate whether unravelling occurs in the hospitality industry two factors are required: (i) favourable traits that distinguish hotels (TripAdvisor ratings) and (ii) an instrument to verify whether a favourable trait is voluntarily disclosed.

##### **4.4.1 Verification & Disclosure Definitions**

Hotel websites represent modern shop windows and online bookings are a primary sales avenue for the industry. This presents a niche for researchers. To consider the frequency of disclosure, I manually verify the presence of the TripAdvisor rating on

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<sup>32</sup> The summated score for a hotel offered by TripAdvisor is more sophisticated than an average score of all contributions. The system incorporates ratings to determine overall satisfaction that is weighted based on the recency of a review and the performance of other hotels.

<sup>33</sup> Perhaps this is best captured by *the Guardian* journalist Kira Cochrane (2011) who suggests that the emergence of the TripAdvisor ratings system has led to "a seismic shift in power, from hotelier to consumer, which has, in many ways, been enormously positive for travellers. Where once we were vulnerable to the quirks and rudeness of countless Basil Fawltys, we now have a source of both warning and redress."

each hotel's official website. As different hotel websites hold alternative designs, a definition to constitute a disclosure is required to confirm whether a voluntary admission is made. For this essay, a hotel is said to disclose their TripAdvisor rating if *at least one* of the following criteria is met: (i) the score is explicitly published on the website or an inbuilt trip advisor (non-endogenous) review section exists (ii) the score is 'one-click away' or a distinct (hyper)link exists to connect the hotel's rating on TripAdvisor's website or (iii) a specific claim to a hotel's TripAdvisor reviews or performance is made on their official website. Visual examples of these criteria are provided in the appendix.

#### **4.4.2 Data & Descriptive Statistics**

One part of the dataset is assembled at a regional level and another on an international scale. This sampling strategy allows one to consider market dynamics locally and cross-cultural differences. The regional sample constitutes hotels in the United Kingdom and the Republic of Ireland. The locations selected represent relatively densely populated cities across the region. The international sample comprises of the following major international cities; London, New York, Paris, Rome, Singapore, Sydney and Tokyo. These cities represent major tourist hubs. Densely populated areas are sampled to ensure that relatively competitive markets are in operation both regionally and internationally. All of the hotels from these locations are sourced from the TripAdvisor platform. Hostels, B&B's, lodges and other forms of accommodation are excluded from the analysis to ensure a well-defined market. All of the included properties held an industry certification.

To be included in the analysis, a hotel must have accumulated over 100 reviews on TripAdvisor. This minimum threshold ensures a precise measurement of hotel quality. While consumer reviews could be argued to produce noisy data, one would

expect more accurate estimates as the number of reviews increase. Furthermore, this sampling procedure is adopted as a sceptic may have worries relating to selective gaming or deceptive acts. Fraudulent behaviour could occur by hotels submitting their own reviews, which could result in spurious correlations caused by inaccurate assessments. The fast pace of the industry (TripAdvisor widgets are updated on a daily basis) and the sheer volume of reviews (TripAdvisor post an average of sixteen reviews and opinions every minute) substantially reduces the likelihood that gaming will systematically alter the recorded review scores<sup>34</sup>.

Data are accessed on the hotel name, location, internal star certification, TripAdvisor rating, the number of reviews on which the rating is based, and whether the hotel disclosed their rating. As online ratings and hotel websites can change rapidly, all data were collected over two short time periods; the regional dataset was assembled during a two-week period during August 2016 while the international data were collected over one month in February 2017.

In total, data are collected on 4,357 hotels across 22 locations globally. The quality measures across the locations are derived from 4,060,830 individual reviews submitted to TripAdvisor. This sample size is substantially greater than earlier studies analysing disclosure decisions: Mathios (2000) provided data on 86 salad creams and, most recently, Luca and Smith (2015) access data on 240 MBA programmes. In light of the findings, two auxiliary datasets are compiled. The first considers disclosures from holiday catalogues. This allows one to consider the

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<sup>34</sup> TripAdvisor have specifically developed a content integrity policy to protect against fraudulent reviewer behaviour. They guarantee that “businesses are not able to influence TripAdvisor to improve their reviews, ratings or ranking” This policy can be accessed online at [https://www.tripadvisor.ie/pages/content\\_integrity\\_policy.html](https://www.tripadvisor.ie/pages/content_integrity_policy.html)



importance of the sales context on the disclosure decision. The second dataset is compiled from Trustpilot. While this data concerns a different market, it allows one to control for the expectation of disclosure. The details of both datasets are outlined in later sections.

#### 4.4.3 Regional Dataset – United Kingdom & Rep. of Ireland

TripAdvisor rating are obtained for 1,490 hotels in sixteen locations in UK and Ireland<sup>35</sup>. It is possible to verify whether this rating is disclosed on the official websites of 1,475 of these hotels. The 15 excluded hotels either had non-operational websites or had recently closed. Table 4.1 summarises the important information for the dataset by location in the regional dataset. While I later investigate the relationship between star ratings and TripAdvisor ratings, it is important to note that both scales are different.

**Table 4.1 Descriptive Statistics – Regional Dataset**

<b>Location</b>	<b>N</b>	<b>Mean Star Rating</b>	<b>Mean Trip Advisor Score</b>	<b>Mean No. Reviews</b>
Belfast	32	3.5	4.1	1,295
Birmingham	78	3.2	3.8	990
Cork	22	3.7	4.2	1,097
Coventry	26	3.2	3.6	695
Dublin	113	3.3	3.8	1,272
Edinburgh	126	3.5	4.1	1,085
Galway	31	3.5	4.1	1,047
Kerry	63	3.7	4.3	748
Leeds	46	3.4	4.0	960
Liverpool	60	3.4	4.1	1,345
London	686	3.5	3.8	1,202
Manchester	72	3.4	3.9	1,499
Newcastle	44	3.3	4.0	823
Nottingham	33	3.2	3.7	752
Sheffield	30	3.3	4.0	777
Waterford	13	3.4	3.8	789
<b>Totals</b>	<b>1,475</b>	<b>3.4</b>	<b>3.9</b>	<b>1,134</b>

<sup>35</sup> These locations are Cork, Dublin, Galway, Kerry and Waterford (Ireland) and Belfast, Birmingham, Coventry, Edinburgh, Leeds, Liverpool, London, Manchester, Newcastle, Nottingham and Sheffield (UK).

The quality measure is established from a total of 1,673,641 reviews. The average number of ratings per hotel is over 1,000 (ranging from 109 to 12,702 - the Park Plaza Westminster Bridge, London).

The lowest average number of reviews in any one location is 696 (Coventry). The maximum is 1,500 (Manchester). TripAdvisor ratings can range from 5 to 0 in increments of .5, with higher ratings more prevalent. In the sample, the following distribution is obtained: 5 (33 hotels), 4.5 (440 hotels), 4 (541 hotels), 3.5 (250 hotels), 3 (96 hotels), and <3 (115 hotels). Note that ratings of 3 or lower are placed into a single bin because they are so rare.

#### 4.4.4 International Dataset

Data are collected for hotels from two sources for seven locations internationally for the second dataset. A pan-continental strategy is used to identify locations. I access TripAdvisor ratings for 3,658 hotels and verify disclosures for 3,568. The ninety hotels are excluded as their website was either not operational at the time of verification or the hotel had recently closed. Table 4.2 summarises key properties of this dataset.

**Table 4.2 Descriptive Statistics – International Dataset**

<b>Location</b>	<b>N</b>	<b>Mean Star Rating</b>	<b>Mean Trip Advisor Score</b>	<b>Mean No. Reviews</b>
London	686	3.5	3.8	1,202
New York	372	3.6	4.2	1,932
Paris	1277	3.3	3.9	509
Rome	755	3.3	3.8	619
Singapore	214	3.5	4.1	1,290
Sydney	119	3.8	3.9	1,406
Tokyo	145	3.2	4.0	574
<b>Totals</b>	<b>3,568</b>	<b>3.4</b>	<b>3.9</b>	<b>901</b>

The quality measure is established from 3,225,773 reviews. The average number of ratings across the sample is over 900 reviews (minimum 100 and maximum 20,037 –

the Marina Bay Sands, Singapore). The lowest average number of reviews in any one location is 509.06 (Paris). The maximum is 1,932.76 (New York). As is the case with the regional dataset, six specific class intervals are identifiable that range from excellent to a pooled category of poor-terrible: 5 (74 hotels), 4.5 (1008 hotels), 4 (1300 hotels), 3.5 (730 hotels), 3 (270 hotels), <3 (186 hotels)

#### **4.5 Analysis & Results**

This essay focuses on information unravelling. Do lower ranked hotels follow the normative prediction and disclose their TripAdvisor score for fear of being thought of as worse than they actually are?

Two contrasting hypotheses emerge; full disclosure (economics prediction) and selective disclosure (behavioural science prediction). The first hypothesis comes from unravelling theory and is a strict prediction; full disclosure will occur for all hotels except the worst ranked. The second hypothesis comes from past empirical tests of disclosure practices. Here, the prediction is that a lower level of revelation will occur; incomplete disclosure will emerge with hotels being more reluctant to disclose the lower their rating.

The outcome of the strict hypothesis can be clearly rejected. For the combined datasets, an aggregate disclosure rate of 43% is observed. Such a finding is incompatible with the full disclosure hypothesis. The selective disclosure trend is however compatible with the second hypothesis. Table 4.3 provides the disclosure proportions for each TripAdvisor categories for the combined dataset. A Kruskal-Wallis test to consider the statistical differences between the disclosure decisions of the six categories for the combined dataset reports significant results at a 1% level of statistical significance between categories ( $\chi^2(5) = 292.17$ ,  $p=0.00$ ). A chi-square

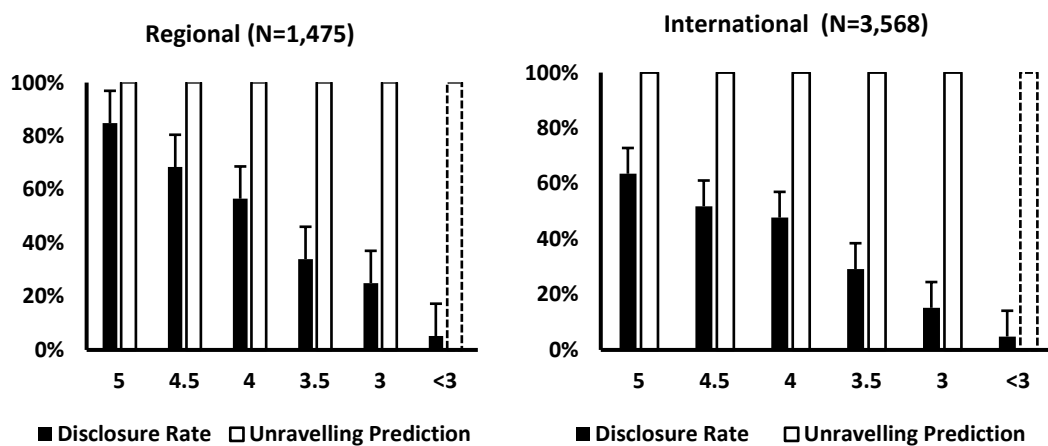
test is carried out to assess the relationship between adjacent proportions (i.e. 5 to 4.5, 4.5 to 4) rather than for differences across the entire range of categories. The associated probability values reveal clear differences between all adjacent intervals.

**Table 4.3 Disclosure Rate by TripAdvisor Category – Combined Dataset**

<b>TripAdvisor Score</b>	<b>5</b>	<b>4.5</b>	<b>4</b>	<b>3.5</b>	<b>3</b>	<b>&lt;3</b>
Complete Dataset - Disclosure (%)	67%	55%	48%	29%	16%	5%
No. of Hotels	83	1253	1642	856	319	204
$\chi^2$	4.61	13.82	84.28	18.77	16.34	-
p-value	0.03	0.00	0.00	0.00	0.00	-

To consider the unravelling result at a regional and international level, Figure 4.1 displays the rates of disclosure (black bars) across the six rating categories hotels can receive. This is compared to the strict prediction of full disclosure derived from the unravelling principle (white bars). For the lowest rating (in this case <3) the prediction is either full disclosure or no disclosure<sup>36</sup>.

**Figure 4.1 Observed and Predicted Rating Disclosures by TripAdvisor Category**



<sup>36</sup> The final white bar of both diagrams is dashed to indicate that sellers are indifferent to disclosure. For illustrative purposes hotels ranked less than three are considered indifferent to disclosure given how few are rating in the range of 1.5-2.5. Technically, only the lowest possible ratings (1.5) should be indifferent to disclosure. Only four hotels in the dataset however received this score. No disclosure was offered for any 1.5 rated hotel.

The unravelling result is incomplete for both the regional and international sample. Only 51% disclose a TripAdvisor score in the regional sample, and 41% in the international sample. As seen in Figure 4.1, the disclosure rate is contingent on a hotel's TripAdvisor rating. A monotonic relationship is observed for both datasets voluntary disclosure decreases as TripAdvisor ratings decline. This finding is consistent with the selective disclosure hypothesis.

At a regional level, whereas over 80% of hotels having a TripAdvisor rating of 5 disclose, this falls (monotonically) to 34% for a rating of 3.5. It is interesting that not all of the 5 rated hotels disclose their rating. This is consistent with recent experimental evidence showing that while the majority of best quality sellers will attempt to signal their relative superiority, not all will do so (Sah & Read, 2017b).

The theoretical prediction that the lowest quality sellers are indifferent to disclosure is approximately compatible with the theoretical prediction. Only 5% in this sub sample ranked <3 disclose a TripAdvisor rating. Internationally, a similar trend is observed. Although a lower level of aggregate disclosure is recorded, the frequency of disclosure declines jointly with TripAdvisor scores. Only 4% of the lowest quality hotels make a disclosure. Statistical differences exist across the range of intervals for the disaggregated datasets also. Significant differences are present between the categories for both the regional (KW:  $\chi^2(5) = 170.31$ ,  $p=0.00$ ) and international dataset (KW:  $\chi^2(5) = 221.28$ ,  $p=0.00$ ). To consider threshold effects between the categories, Table 4.4 provides the disclosure proportions for each TripAdvisor categories regionally and internationally. Results from chi-square tests from adjacent categories are also reported to identify the thresholds. The associated probability values reveal statistical differences between the adjacent intervals with the exception

of the comparison of categories 3.5 and 3 for the regional dataset. No statistical differences in the disclosure decisions are reported between these hotel groups.

**Table 4.4 Disclosure Rate by TripAdvisor Category – Regional & International**

<b>TripAdvisor Score</b>	<b>5</b>	<b>4.5</b>	<b>4</b>	<b>3.5</b>	<b>3</b>	<b>&lt;3</b>
Regional–Disclosure (%)	85%	68%	57%	34%	25%	5%
$\chi^2$ (p-value)	3.91(0.05)	14.18(0.00)	35.64(0.00)	2.55(0.11)	16.78(0.00)	-
Int.–Disclosure (%)	64%	52%	48%	29%	15%	5%
$\chi^2$ (p-value)	3.80(0.05)	3.81(0.05)	66.22(0.00)	20.36(0.00)	12.07(0.00)	-

#### 4.5.1 Estimation

To test for the presence of unravelling and to analyse the direction of the relationship seen in Figure 4.1, a probit regression is estimated for the basic model identified below. Consistent with past disclosure research, qualitative response models offer the most appropriate means to estimate the impact of information on a seller's disclosure behaviour. In particular, this allows one to predict the likelihood of a disclosure by hotels in different TripAdvisor categories with the probit regression (*ceteris paribus*). The specification of this model remains consistent across the alternative estimations that consider both datasets. The dependent variable is a categorical variable where  $DISCLOSURE_{TA}$  is defined as equalling 1 if a disclosure is made and 0 otherwise. The covariates are individual dummy variables indicating if a hotel's TripAdvisor score falls within a specific class interval. For the purposes of regression, the omitted variable is the category of worst ranked hotels (hotel category <3). Additionally, locational specific dummy variables are included in the model to investigate if spatial dynamics influence disclosure decisions.

$$DISCLOSURE_{TA} = \alpha_0 + \beta_1(rating5) + \beta_2(rating4.5) + \beta_3(rating4) + \beta_4(rating3.5) + \beta_4(rating3) + \beta_5(rating < 3) + \beta_5(Location) + \varepsilon$$

Marginal effects for seven different samples, starting with the combined datasets, are reported in Table 4.5. These marginal effects reveal how changes in the disclosure decision change in response to a *ceteris paribus* changes in a covariate and identify the linearity apparent in Figure 4.1. A measure of localised fit is also reported. Diagnostic checks on all regressions are conducted to ensure that the model is appropriately specified. A link test on each probit regression reports non-significant results ( $P > 0.90$  for all regressions) indicating that the generalised model does not suffer from specification errors. As only two distinct locationally specific relationships are identified these coefficients are not included in the results. The two incidences are noted below and subject to explicit analysis.

The first regression (I) in Table 4.5 displays the average marginal effects for the combined datasets. Relative the reference group of the lowest rank (<3 -Poor-Terrible), hotels ranked from 3 to 5 are more likely to disclose their TripAdvisor performance. This result is statistically significant at the 1% level for each category. Relative to the base category, hotels ranked 3 are 24% more likely to disclose. The likelihood of disclosure increases with the TripAdvisor rating; for the combined datasets elite hotels are 75% more likely to reveal their performance.

**Table 4.5 Probit Results – Marginal Effects**

OV = <3 Hotels							
DV = 1 if Disclosure, 0 Otherwise							
	(I)		(II)		(III)		
<b>Model: Probit / Sample</b>	<b>Combined</b>	<b>UK &amp; Ireland</b>	<b>London</b>	<b>Provincial BI</b>	<b>International</b>	<b>Paris</b>	<b>Rome</b>
Rating 5	.755*** (.070)	.920*** (.107)	.814*** (.111)	- -	.739*** (.075)	.601*** (.130)	.496** (.163)
Rating 4.5	.640*** (.050)	.729*** (.064)	.684*** (.071)	.727*** (.128)	.639*** (.057)	.402*** (.105)	.501*** (.110)
Rating 4	.577*** (.051)	.620*** (.065)	.681*** (.071)	.510*** (.131)	.607*** (.057)	.423*** (.104)	.475*** (.109)
Rating 3.5	.395*** (.053)	.420*** (.071)	.446*** (.081)	.361* (.139)	.431*** (.059)	.381*** (.106)	.264 (.114)
Rating 3	.242*** (.059)	.329*** (.082)	.308*** (.095)	.408* (.159)	.258*** (.066)	.120 (.118)	.072 (.129)
N	4,357	1,475	686	545	3,568	1,277	755
Pseudo R <sup>2</sup>	0.07	0.12	0.16	0.08	0.09	0.03	0.08

Significance level: 1%:\*\*\*, 5%:\*\*, 10%\*



The second series of estimates (II) addresses the causal relationships for the regional dataset only. This allows the consideration of regional, in addition to state specific effects<sup>37</sup>. Firstly, the complete dataset for the British Isles is considered. Statistically significant results are recorded for all coefficients. A strong initial signal to initiate an unravelling process is observed; hotels rated as elite are 92% more likely to disclose their score relative to the worst ranked hotels.

As London accounts for 46% of the regional dataset it is considered separately. Analysing this specific sub-sample is motivated by the question of whether the size of market and an expected greater intensity of competition, alters disclosure decisions. London also represents a major international city and tourist hub, in comparison to smaller and potentially less desirable regional cities. The probabilistic results for London only subsample are consistent with the theoretical direction of the disclosure hypothesis. Excellent hotels, rated as 5, are the most likely to offer a voluntary disclosure. Hotels rated as second and third best respectively are equally as likely to make a disclosure.

The final regression for the regional dataset (II) considers 545 UK (non-London) hotels. This subsample brings greater homogeneity to the regional dataset. The nature of London, as a major international tourist destination, may elicit externalities or other types of spill over effects from reviewers. To investigate this, the final sample restricts the cities of analysis to provincial city locations (Provincial BI), providing destinations that are of greater spatial comparability. The statistical results

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<sup>37</sup> For instance, the Irish government charges a lower VAT rate of 9% on tourist-related services. Given the sample size of Irish hotels it is not feasible to estimate a probit regression. It is noteworthy that evaluating the unravelling principle for both Irish and UK markets using a linear probability model (LPM) reports analogous results. Analysing just the Irish market alone with a LPM, reveals a similar linear relationship to that of the UK sample. All Irish hotels rated as 5 make a voluntary disclosure while hotels with a rating of 4.5, 4 and 3.5 have voluntary disclosure rates of 63%, 51% and 17% respectively. None of the lowest ranked Irish hotels (all rated 3.5) make a disclosure.

observed for this subsample do not exhibit the exact linearity of the London only sample. While a strong statistical relationship exists between disclosure decisions and TripAdvisor scores for hotels rated as 4.5 and 4, this weakens for lower ratings. Rating 5 is dropped from this analysis as it produced a perfect prediction for the dependent variable.

The third series of estimates (III) considers the unravelling results for the second dataset, evaluating hotel disclosures in the context of international locations. Similar to the peripheral UK cities providing greater homogeneity on a provincial scale, analysing major international destinations allows one to consider a homogenous sample at a global level. Furthermore, an international comparison can provide insight to cross-cultural disclosure activity and the effectiveness of the TripAdvisor signal outside of the UK and Ireland. The first finding from the combined international dataset, observable in Figure 4.1, is the similar monotonic relationship apparent from the regional dataset. Although the rate of disclosure is lower internationally, similarly robust statistical relationships are reported and a downward trend is observed.

As noted, two locational specific effects are reported for the international sample; hotels in Rome and Paris are between 12% and 18% less likely to offer a voluntary disclosure (at a 1% level of statistical significance). Given these dynamics, and as both Paris and Rome represent substantial sub-samples, the second two regressions for the international dataset (III) investigate the likelihood of disclosure in these two locations exclusively. Regarding Paris, a similar downward relationship exists, but the rate of disclosure falls dramatically for the second-best category of hotels; those rated 4.5, while still statistically more likely to disclose a score relative to the worst hotels, only do so 40% of the time. As regards Rome, a disclosure threshold is

observed with all hotels ranked at 4 or above significantly more likely to disclose their rating. This decision approximates the same probability, 47.5% to 50%, and is independent of the rating. These findings are interesting and may point toward the weakening power of the TripAdvisor signal outside of the regional market. The international sample records a lower total level of disclosure, a consequence which could relate to role of cultural norms and the adoption of the TripAdvisor signal.

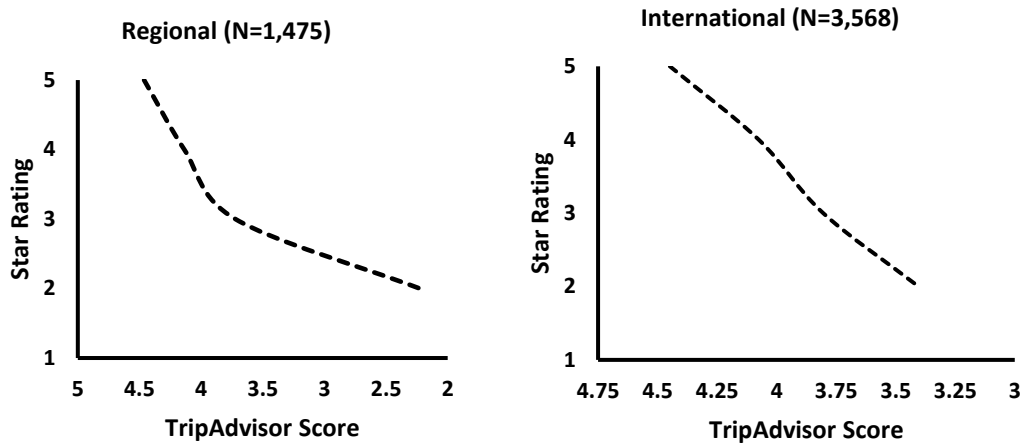
#### **4.5.2 The Star Certification-TripAdvisor Interaction**

Next, I turn to the interaction between a hotel's star certification conferred by the industry and the TripAdvisor rating. These certifications are based not (typically) on customer experience, but on non-standardised factors like whether rooms have internet, quality of the bedding, the presence of minibars, and so on. The star rating coincidentally is over the same numeric range as the TripAdvisor score. I investigate whether hotels use their certification as an anchor, and so are reluctant to disclose TripAdvisor scores that do not match or exceed their certification. This could partly explain the tendency for even high TripAdvisor scores to remain undisclosed.

There is a relationship between certification and TripAdvisor scores ( $R = 0.45$ ).

Figure 4.2 displays TripAdvisor ratings (regionally and internationally) for each class of hotel star certification (2-5). These represent mean TripAdvisor ratings for each star certification category (95% CIs [4.45, 4.56], [4.11, 4.47], [3.66, 3.76] and [2.11, 2.25] for the regional dataset and [4.41, 4.48], [4.04, 4.10], [3.77, 3.83], [3.34, 3.46] for the international dataset). As can be seen, 5-star hotels receive high TripAdvisor scores (on average around 4.5) and the average score declines with level of certification.

**Figure 4.2 Star Rating-TripAdvisor Indifference Curves**



The data suggest that, as expected, hotels do use their certifications as a reference point. Table 4.6 and Table 4.7 report disclosure decisions as a function of star rating and TripAdvisor rating. As can be seen by inspecting the table row-by-row (i.e., holding TripAdvisor rating constant), there is a tendency for hotels with lower star-certifications to be more likely to disclose their TripAdvisor rating. This is especially true for the regional dataset. By taking a hotel's industry certification into consideration, these contingency tables display the percentage of disclosure decisions for twenty-one subsamples (regionally) and twenty-two subsamples (internationally). Comparing mean ranks between the star ratings reports a statistically significant difference between the disclosure decisions for the categories identified in Table 4.6 for the UK and Ireland ( $\chi^2(3) = 123.47$ ,  $p = 0.00$ ) and in Table 4.7 for the international destinations ( $\chi^2(3) = 189.78$ ,  $p = 0.00$ ). Comparing mean ranks for the two complete hotel classifications (4-star and 3-star) also reports statistically significant differences for the UK and Ireland ( $t = 7.01$ ,  $p = 0.00$ ) and internationally ( $t = 7.32$ ,  $p = 0.00$ ).

**Table 4.6 Disclosure Decisions (%) by TripAdvisor & Star Ratings Criteria - Regional Dataset**

TA Rating/Star	5	4	3	2
5	83% (23)	89% (9)	100% (1)	-
4.5	51% (87)	68% (216)	82% (132)	40% (5)
4	56% (16)	55% (237)	58% (253)	57% (35)
3.5	50% (2)	28% (64)	36% (150)	35% (34)
3	-	20% (5)	25% (67)	25% (24)
<3	-	0% (3)	7% (68)	2% (44)

**Table 4.7 Disclosure Decisions (%) by TripAdvisor & Star Ratings Criteria – Int. Dataset**

TA Rating/Star	5	4	3	2
5	74% (31)	57% (30)	54% (13)	-
4.5	48% (224)	51% (439)	55% (311)	56% (34)
4	58% (48)	51% (498)	45% (634)	43% (120)
3.5	33% (6)	30% (187)	32% (399)	20% (138)
3	0% (1)	7% (43)	16% (142)	15% (97)
<3	-	14% (14)	6% (83)	1% (76)

While categorising the data according to both criteria reduces the size of the subsamples, further insights can be gained by testing for differences *within* each star rating. Firstly, the frequency of TripAdvisor disclosure decisions for hotels ranked as 5-star declines when they fail to achieve the equivalent maximum TripAdvisor score at both a regional ( $\chi^2=7.66$ ,  $p=0.05$ ) and international level ( $\chi^2=10.09$ ,  $p=0.03$ ). Hotels graded as 4-star and 3-star, importantly where TripAdvisor scores can be greater than or less than an industry rating, are observed as having higher rates of disclosure when outperforming their star rating and lower rates when underperforming. Statistical differences between TripAdvisor ratings are reported for 4-star hotels (regionally -  $\chi^2=43.36$ ,  $p=0.00$ ; internationally -  $\chi^2=59.69$ ,  $p=0.00$ ) and for 3-star hotels (regionally -  $\chi^2=137.85$ ,  $p=0.00$ ; internationally -  $\chi^2=125.60$ ,  $p=0.00$ ). These contingency tables also provide insight into possible underreporting from lower star rated hotels. Despite a relatively strong TripAdvisor performance from many 3-star and 2-star hotels, substantial proportions of the subsamples fail to

disclose ratings above their star certification (e.g. only 43% of 2 star hotels in the international dataset rated as 4 on TripAdvisor make a disclosure).

To summarise the results, I report three major findings; (i) measured from the strict prediction of the unravelling principle, I find an incomplete level of disclosure that reveals a directional relationship in support of the incomplete disclosure hypothesis; (ii) monotonic disclosure patterns exist both regionally and internationally, with few spatial nuances; (iii) the data indicates that internal certification can act as a reference point for a disclosure.

#### **4.6 Salience of Disclosure: The Case of Holiday Catalogues**

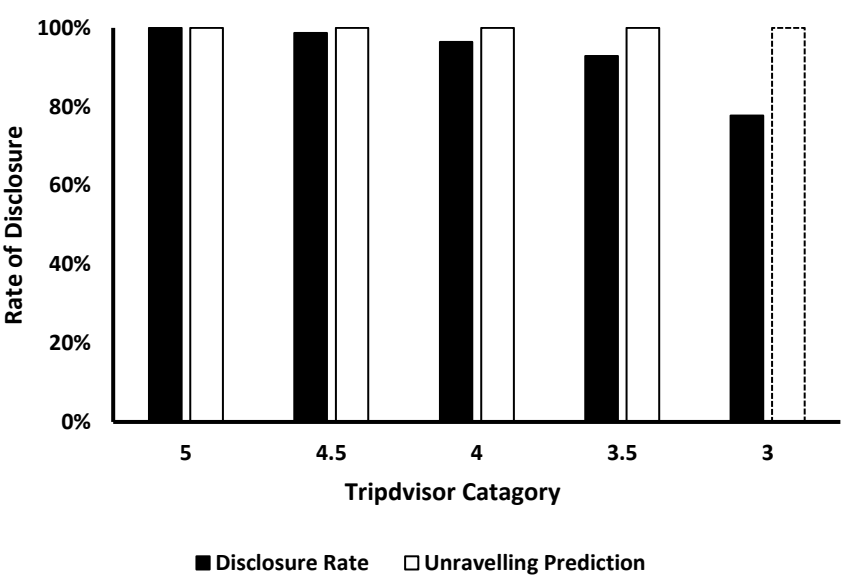
Hotel websites are stand-alone entities and have a great deal of heterogeneity in their presentation. This heterogeneity has the potential to “mask” nondisclosure of TripAdvisor scores, or any other information the hotel may choose not to disclose. Hotel information is also often provided in holiday catalogues, which present hotel data in a much more homogeneous way and consecutively, so that any missing information will be highly salient.

To investigate whether TripAdvisor disclosure increases in this context this section compiled data from two holiday catalogues - *Jet2Holidays* and *Thomson*. The *Thomson* catalogue consists of hotels and resorts included in the 2017 *Spain, Portugal & Cape Verde* catalogue. All hotels and resorts in the *Summer Holidays 2017* catalogue are considered for *Jet2Holiday*.

Data are available for a total of 790 hotels across both catalogues for a total of thirty-two European destinations. Unlike hotel websites, the disclosure levels are very high. The Thomson catalogue provides full disclosure; a TripAdvisor score is included for

179 hotels in the catalogue. 6% of these hotels score 3.5 or under on TripAdvisor and the rating is included for all of these hotels. Only for hotels refurbished (4) or newly opened (5) is a TripAdvisor rating not provided. In the absence of a disclosure, a justification is offered (refurbishment symbol or new hotel symbol). A larger sample is available on 611 disclosure decisions from the *Jet2Holiday* catalogue. A disclosure rate of 97% is recorded for this second intermediary. Refurbished or new hotels are excluded from the non-disclosure sample. The distribution of hotels in the *Jet2Holiday* catalogues for each category is; 5 (8 hotels/apartments), 4.5 (228 hotels/apartments), 4 (280 hotels/apartments), 3.5 (84 hotels/apartments), 3 (9 hotels), <3 (2 hotels/apartments). Figure 4.3 reveals the higher level of disclosure in this context for the *Jet2Holiday* sample and the marginal rate of non-disclosure in the relatively lowest rated category.

Figure 4.3 Catalogue Disclosures - *Jet2Holidays*



To evaluate the likelihood of a catalogue disclosure, specific point estimates can be attained from a linear probability model (LPM) of the same form adopted for the previous regressions. This allows one to consider whether the differences in the

probability of a disclosure relative to a base category for the catalogue data. For the purposes of the LPM, the category of 3 and <3 are merged and subsequently omitted. Relative to these hotels, those ranked greater than or equal to 3.5 are not more likely to exhibit selective disclosure (all  $p$ 's  $>.17$ ). As expected, no statistically significant differences are reported in the disclosure decisions between the rating for the catalogue data ( $\chi^2(4) = 3.74$ ,  $p = 0.44$ ).

#### **4.7 Non-Disclosure & Motivations**

Consistent with Mathios (2000), I observe a monotonic relationship between ratings and disclosure decisions. The primary domain of analysis is online TripAdvisor disclosures by hotels. The central finding is that the strict unravelling prediction fails to materialise. Approximately half of the regional dataset opts to disclose their TripAdvisor score while less than half of the international sample makes a voluntary disclosure. The lowest ranked hotels are more likely to withhold their rating both regionally and internationally. By analysing holiday catalogue disclosures, which provide an alternative sales medium and simpler choice environment, disclosure rates are significantly higher. In this different sales context, disclosure is carried out by a third party and nondisclosure is salient.

Given that the proportion of hotels that offer a voluntary disclosure is highest for the best hotels, at both a regional and international level, it is natural to speculate why a fuller level of disclosure does not occur? Various explanations exist to explain the results. These are not mutually exclusive but are discussed independently here. Furthermore, I introduce the second supplemental dataset to consider the expectation of a quality disclosure.



#### **4.7.1 Internal Certification**

Firstly, as Table 4.5 and Table 4.6 suggest, hoteliers may rely on an internal certification system conferred by the industry when TripAdvisor casts them in a light which is not consistent with their internal certification. While no qualitative (or even anecdotal) evidence exists to suggest an internal certification rating is solely relied upon for branding or promotion activities, this star rating could act as a reference point to determine whether a disclosure is made. While it is important to stress that both ratings systems do exist as different scales, and are not substitutional systems, it is not improbable that guests could conflate the scales. For instance, when a hotel is already conferred with a high star rating by the industry, a TripAdvisor disclosure may not influence a hotel's profitability or reputation. Understanding whether internal certification acts as a reference point for disclosure should be a future line of enquiry.

#### **4.7.2 The Countersignalling Hypothesis**

Although I find resilient evidence of non-disclosure trends in the hospitality industry, this is a market where an elite hotelier could equally choose to rely on reputation rather than on third party rating systems. 15% of hotels awarded the rare 'excellent' TripAdvisor rating in the UK and Ireland choose not to disclose their score. This non-disclosure rate increases to 36% internationally. This type of signalling behaviour by elite hotels could be consistent with a *countersignalling* hypothesis and is indicative of the complexity of the signalling process. One is left speculating why disclosure rates are not higher for the best hotels and for hotels significantly outperforming their star rating. It is not implausible to suggest that

unexploited gains from trade exist. For instance, only 55% of 3-star hotels internationally reveal the second best TripAdvisor score of 4.5.

To consider if countersignalling is a plausible interpretation for non-disclosure I consider data for hotels that are not only elite but also global leaders. I collect data on 157 Trip Advisor disclosures for hotels certified as five stars and *also* included in the 2017 *Forbes Travel Guide– Star Award Winners*. These hotels are located across twenty-one countries globally and none of these hotels are rated lower than 4.5 on TripAdvisor. A disclosure rate of 48% is observed for this sample. The Forbes Travel Guide contains 47 hotels with a five-star certification *and* the maximum TripAdvisor rating. While no difference exists between the Forbes data and hotels in the international sample that fulfil the same criteria ( $\chi^2=1.15$ ,  $p=0.28$ ), the disclosure rate varies from that of the elite regional hotels ( $\chi^2=9.72$ ,  $p=0.00$ ). Elite regional hotels signal more often. Interpreted through the lens of countersignalling, this result could be considered as partial evidence in support of the view that outstanding international hotels take exceptional reviews as a given, and either do not feel the need to disclose them or indeed believe it might be demeaning to do so.

#### **4.7.3 Heterogeneous Preferences & Market Segmentation**

A full unravelling result may not be observed if consumers retain heterogeneous preferences for quality or hold tightly constrained budgets. While I argue that preferences for hotels should be *relatively* well-behaved in comparison to other experience goods, there is room for debate on this point. Where multiple product attributes exist a full-disclosure equilibrium may fail to materialise (Hotz & Xiao, 2013). Although the markets for low and high quality are clearly differentiated,

consumers holding a preference for low quality hotels may not care for, or be influenced by, the provision of quality information.

The supply side interpretation of this explanation reasons that greater levels of disclosure may not emerge if smaller markets are nested within a wider market. If the hotel market is deeply segmented in these locations, implying that hotels only compete against a range of similarly rated hotels, a seller may choose non-disclosure, assuming that consumers are selecting a hotel from an understood and narrower quality range offered by few competitors. Likewise, if higher quality hotels understand that consumers are restricted by their budgets, despite their preference for greater quality, disclosure may not make a difference to their hotel choice; the price of the product may still be beyond the budgets of a section of the market, irrespective of a quality signal. If this is the case, disclosure may only serve to intensify competition with close rivals.

#### **4.7.4 Strategic Non-Disclosure**

Strategic non-disclosure is a plausible explanation to explain the failure of the strict theoretical prediction. Although nondisclosure should be equally revealing to consumers, hoteliers may choose to hide a TripAdvisor rating for darker motives. Specifically, TripAdvisor ratings may not be disclosed if hotels believe consumers cannot interpret non-disclosure in the worst possible light. Recent experimental evidence suggests that individuals suffer from this problem and that the optimal policy for service providers with average ratings can be to conceal it (Sah & Read, 2017b). If interpreted in this manner, the findings are consistent with models of limited strategic thinking. Following the reasoning of Brown et al (2012), if hotels anticipate that consumers hold the most limited ability to make strategic inferences

(level-0), they, as more strategically sophisticated agents (level-1), choose not to reveal TripAdvisor ratings.

This explanation is strengthened by significantly higher levels of disclosure in an alternative sales setting. In a context where non-disclosure is salient, holiday catalogues, the rate of TripAdvisor admissions significantly increases, even for relatively lower ranked hotels. The supplementary data on catalogue disclosures from intermediary agents indicates that the context of the consumption decision is important to whether a disclosure occurs. The high level of disclosure in these settings indicates that the potential for hotels to strategically veil their rating increases when choices move away from set formats.

#### **4.7.5 Disclosure Expectations**

A clear result is that disclosure is higher in the regional sample. This raises new questions. In particular, is the expectation of a TripAdvisor disclosure less likely across cultures? A behavioural explanation for non-disclosure, outside of those discussed, is that a TripAdvisor rating is not a recognised or expected signal in international markets, or that the platform has only partially diffused internationally.

An assumption of the unravelling equilibrium is that there must be common knowledge between buyers and sellers; both parties must understand the signal and the environment in which they transact. If this assumption is undermined by cultural or market norms in a given location, disclosure may not occur. Although few spatial results are recorded, hotels located in Rome and Paris are less likely to offer a disclosure.

To consider whether the expectation of a disclosure influences the patterns observed, I introduce a second supplementary dataset and consider the relationship between disclosure and quality in a market context where the common knowledge assumption is tenuous. To do this I consider voluntary quality admissions for 489 non-bank financial services firms (NBFS) who receive online appraisals from the Danish review firm, Trustpilot. This is a relatively well-defined market on the Trustpilot platform and is a market that has been subject to much scrutiny. This platform is selected as, like TripAdvisor, the quality scale relies upon eWOM. Comparable to hotels adopting the TripAdvisor platform, the NBFS industry has embraced this lesser-known certification platform as a third-party signalling mechanism. The expectation of a disclosure is scarcely anticipated by consumers however<sup>38</sup>. This allows one to ask if the frequency of disclosure, as a function of quality ratings, is altered by consumer expectations.

Firms are rated on an ordinal quality scale, from low (0) to high (10) on Trustpilot. A comparable procedure and analysis is adopted for this dataset. For an admission to occur, the following disclosure definition is adopted and a firm must fulfil at least one of the two criteria; (i) the firm explicitly publishes their Trustpilot rating on their website homepage or (ii) the firm refers to their Trustpilot performance, without explicitly stating a star rating or score. Data are accessed on 504 NBFS firms from the Trustpilot platform (343 UK/Ireland and 161 USA). Only firms with at least 100 individual consumer reviews are included in the analysis. Verifications took place

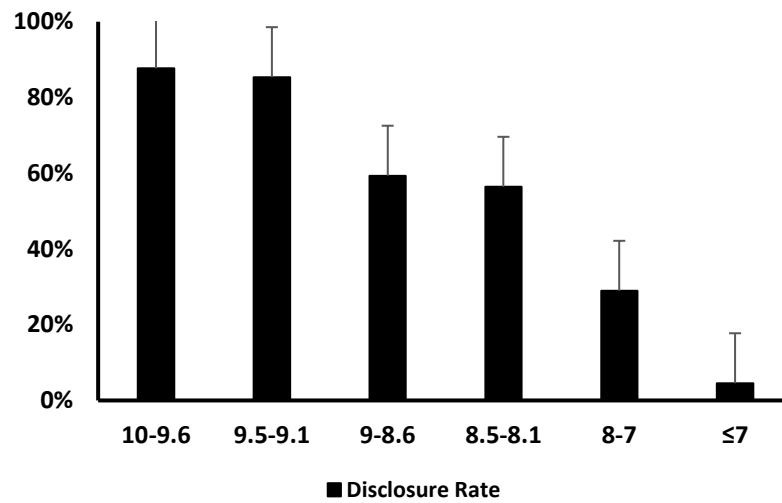
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<sup>38</sup> The differences in the diffusion of these signals is corroborated by comparing the ‘interest over time’ of both signals via Google Trends; TripAdvisor has an interest over time score of 75, in comparison to a considerably lower score of 2 for TrustPilot. These scores represent search interest on Google relative to the highest point in December 2017. A value of 100 is the peak popularity for a term. A value of 50 means that the term is half as popular. Likewise, a score of 0 means the term was less than 1% as popular as the peak.

for 489 firms. At the time of verification, 15 NBFS websites were either non-operational or the firm had ceased to trade. These data were collected over three weeks in April 2017. While the primary product offered by these firms differs, and many overlapping products are on offer, seven specific categories are identifiable. These allows one to classify the primary function of the NBFS firm. These are; pension and investment (57), insurance (138), short term personal and business loans (124), debt services and tax advisory (48), currency and exchange (75) and informational based organisations such as price comparison firms and credit score or switching services (47).

Accordingly, the firms are classified according to the following intervals: 10-9.6 (114), 9.5-9.1 (164), 9-8.6 (91), 8.5-8.1 (39), 8-7 (38) and  $\leq 7$  (43). These review measures are derived from 814,633 individual consumer appraisals. On average, each firm had 1,666 reviews, with a median review of 452 reviews (min 100, max 40,087). The UK/Irish firms have a higher average number of reviews, 1,986 (min 100, max 40,087). This is greater than US firms that have an average number of 940 reviews (min 100, max 8,893). The total rate of disclosure across both the UK/Ireland and the USA is 63%. This is weighted toward higher ranked firms in both markets. Figure 4.4 shows the proportion of admissions for this additional data.

**Figure 4.4 Observed Rating Disclosures by Trustpilot Category**



Similar to TripAdvisor disclosures, the full unravelling result does not emerge for the combined sample or for either market individually. The rates of disclosure for the UK/Irish sample is: 88% (10-9.6), 80% (9.5-9.1), 61% (9-8.6) 57% (8.5-8.1), 27% (8-7) and 0% ( $\leq 7$ ). For the U.S the rates of disclosure are: 72% (10-9.6), 55% (9.5-9.1), 56% (9-8.6), 55% (8.5-8.1), and 38% ( $\leq 8$ ). A monotonically decreasing disclosure relationship is observed for the complete sample. Once a firm is conferred a review score of less than or equal to 8, the rate of disclosure reduces substantially.

Whilst it is expected that at least one category stochastically dominates another in Figure 4.4 ( $\chi^2(5) = 83.80$ ,  $p = 0.00$ ), chi-square tests are conducted between adjacent categories to investigate the disclosure differences between categories. This allows for the identification of any threshold effects. A chi-square test reports statistically significant differences across the disclosure proportions of the first and second categories ( $\chi^2 = 10.53$ ,  $p = 0.01$ ), second and third ( $\chi^2 = 3.81$ ,  $p = 0.05$ ), fourth and fifth ( $\chi^2 = 3.82$ ,  $p = 0.05$ ) and fifth and sixth ( $\chi^2 = 8.83$ ,  $p = 0.00$ ). No statistical differences are reported between those ranked in the third and fourth category ( $\chi^2 = 1.08$ ,  $p = 1.08$ ). These differences indicate that two upper disclosure thresholds exist

between those rated 10-9.6 and 9.5-9.1 and also for those rated 9.5-9.1 and 9-8.6. No middle ranked threshold effects are observed. Equally, two lower rank thresholds are observed between those ranked from 8.5-8.1 and 8-7 and finally for those ranked 8-7 to under 7.

A probit model similar to the specification previously identified is estimated to produce specific probabilistic estimates regarding the likelihood of a disclosure. An addition to the model is that it introduces a vector of controls relating to the primary product of the firm. All of the reported estimates are for the marginal effects of the probit model; this allows one to understand the practical implications of the estimates.

Relative to the worst ranked firms (omitted category), firms ranked in the highest category 10-9.6, are 88% more likely to provide a Trustpilot admission (RSE = .089,  $p=0.00$ ,  $z=9.80$ ). The monotonic relationship observable in Figure 4.4 is recognised in the point estimates; the second category is 70% more likely to provide a Trustpilot admission (RSE = .091,  $p=0.00$ ,  $z=7.68$ ) The third and fourth are 59% (RSE = .098,  $p=0.00$ ,  $z=6.06$ ) and 55% (RSE = .109,  $p=0.00$ ,  $z=5.05$ ) more likely to offer a disclosure respectively. Relative to the lowest category those ranked 8-7, in the second lowest class interval are 37% more likely to make a disclosure a 5% level of statistical significance (RSE = .115,  $p=0.02$ ,  $z=3.17$ ). No statistically significant results are reported for firms with alternative primary products; disclosure is not influenced by a firm's specialisation (i.e. pay-day loans, insurance or debt services). While a similar disclosure pattern is observed across both markets, with the elite rated firms having the highest level of disclosure (88% UK/Ireland; 72% US), statistical differences are reported at a 10% level of significance between the two the markets. Albeit a relative minor coefficient size, firms in the UK are 11% more



likely to make a disclosure when compared to US based operations ( $RSE = .040$ ,  $p = 0.08$ ,  $z = 5.05$ ).

Trustpilot rating disclosures for NBFS shows that even when providers do not have a reason to disclose, as the signal is less expected, a similar disclosure relationship arises. Elite providers offer a disclosure while relatively inferior ones opt for non-disclosure. I interpret this as evidence that the common knowledge assumption relating to consumer expectations (or the structure of the environment faced by consumers) is inconsequential to the disclosure patterns.

#### **4.8 Conclusion**

This essay builds on previous empirical assessments of strategic disclosure by testing the unravelling principle in a new domain. Constructing a sizeable dataset from a third party rating system – TripAdvisor, I study the disclosure decisions and the unravelling principle for 4,357 hotels. Two smaller supplementary datasets allow the consideration of peripheral questions that emerge from the results. The primary finding is that the strict equilibrium prediction of the unravelling principle - full information revelation - is incomplete. Despite the fact that a disclosure process is set in place, with 85% of the hotels regionally and 64% of hotels internationally, ranked as ‘5-excellent’ voluntarily disclosing their TripAdvisor performance, a substantial degree of disclosure (49% and 59% respectively) fails to transpire. A linear relationship is observed for both regional and international datasets, a trend that matches the directional predictions of the unravelling principle only. The lowest ranked hotels display a tendency to hide their TripAdvisor rating. An explicit emphasis is placed on three locations given the size of the market (London) and the aggregate results reported (Paris and Rome). An analysis of the interaction between

two scales which could be conflated, TripAdvisor scores and star ratings, suggests that hotels believe their certification will be weakened if a low TripAdvisor score is revealed.

Two additional datasets provide further insights to the topic. Firstly, when the same signal is considered in a less complex choice environment, where alternative options can be compared and the salience of nondisclosure is increased, I show a result that approximates full information revelation. In this catalogue context, no statistical differences exist across the disclosure decisions of hotels/apartments that hold alternative TripAdvisor ratings. While past research has shown that the context and comparability of a choice influences consumer decision making (i.e. Hsee, 1998), this result reinforces the importance of context from the seller's side of the bargain. What information is disclosed by sellers is regulated by the sales medium.

A second additional dataset allows the consideration a theoretical point relating to the expectation of a disclosure across markets. I identify a similar disclosure pattern for a market with an analogous but unanticipated signalling mechanism. This is a signal which is arguably not expected to be seen by consumers. Despite the absence of these consumer expectations, which would suggest that firms are not required to make a disclosure, a majority still do. I take this as evidence that, despite the fact that consumers may not expect a disclosure, similar disclosure patterns arise regardless of what the consumer anticipates.

Irrespective of the behavioural motivations underlying non-disclosure, failing to provide consumers with informative additional information can have practical first-order and second-order implications for the industry. Given the limited amount of poorly rated hotels that disclose a score, the results presented here may have

implications for practitioners seeking to improve the experience of tourists. While the information on TripAdvisor is publically available, and hence there is no grave concerns mandating any form of intervention, whether consumers can infer the implications of non-disclosure by hoteliers when placing a reservation online is questionable. Past research has highlighted the presence and salience of quality ratings disclosures as a significant contributor in decision making (Luca & Smith, 2013). Of all of the assumptions underpinning the unravelling principle, the rational expectations conjecture may be the most onerous. A significant literature in behavioural decision research has identified that individuals face psychological barriers when required to interpret missing information rationally. Failing to recognise this logic can be a source of naïve judgement, a behaviour which is perhaps best summarised by the acronym *WYSIATI* - supposing that “*what you see is all there is*” (Kahneman, 2011 P.85). Urging consumer caution in online markets and emphasising the importance of seeking out additional information is a clear recommendation emerging from the findings.

A second-order implication of the high level of non-disclosure relates to organisational ethics and practices adopted by the industry. Conditional on hoteliers realising that consumers struggle to process missing information effectively, and in the face of strong competition, a schism can emerge between professed and revealed preferences of hoteliers. Although hoteliers claim that their interests are synchronised with those of consumers, individually they may face a financial incentive to strategically hide information. Ensuring a fair digital market with reference to a competitive practices and online review systems is already a priority for British Hospitality Association (BHA, 2016a, BHA, 2016b). As is understood, such recommendations are yet to extend to disclosure.

Finally, the comparison of signals based on alternative eWOM platforms has deeper theoretical implications for information unravelling. The results indicate that a consumer's knowledge of the transaction environment and one's anticipation of a signal is independent of, perhaps, a 'universal' monotonic disclosure relationship, wherever a quality range exists. This posits theoretical questions for economists who evaluate the strength of signals in markets – whether anticipated or not, it is unlikely that unflattering information will be disclosed unless non-disclosure is highly salient.

It is important to note the limitations of this study and additional directions for future research. Firstly, this study is possible due to publically available information; while the information environment studied can be thought of as being as unbalanced, this asymmetry is impure and any imperfections to the information structure can be remedied by a savvy consumer. Hence, whilst significant datasets can be assembled to explore this topic, the strength of the test is limited. Secondly, I do not have access to data which could offer valuable insights. While on the surface there does not appear to be any missing information on common disclosure costs faced by hoteliers, I do not have information on certain demand and supply side factors. In particular, qualitative data concerning the hotel reviewers or detailed information relating to a hotelier's disclosure motivations. These can limit the inferences one can make regarding the underlying behavioural motivations for non-disclosure. Thirdly, richer review data may be available to future work. The one dimensional TripAdvisor measure may hold a non-linear component or could be subject to reference dependent preferences. Weighted versions of this index could offer an increasingly sophisticated ratings going forward.

## **5. CONCLUSION**

The purpose of this thesis is to import insights from psychology to study economic scenarios where adverse selection can arise. The essays focus on decision-making in bilateral trades, auction environments and consumer settings. Over the course of this thesis, I offer insights on the general theme of negotiator cognition, across multiple markets, through utilising alternative methods. The contributions have an application to general topics and also to niche industries.

The findings are reached by (i) conducting experimental tests of previously unexplored questions and (ii) undertaking field studies in new domains through the construction of novel datasets. Throughout the thesis I argue why researching at the intersection of microeconomic theory, insofar as it concerns information, and psychology is important. These motivations are general, as discussed in the introduction, but are also specific to developing literatures. Making a contribution to developing literatures is a key goal of this thesis; Essay Three is at the forefront of investigating the (behavioural) economics of disclosure.

The first objective of this conclusion is to summarise the major findings of the three essays. This is carried out in section 5.1. Secondly, section 5.2 reflects upon the results in light of the research agenda and discusses the directions for future research. Whereas specific conclusions are reached in each individual essay, this part of the thesis serves to interpret the findings from a general perspective in light of the introductory objectives. Thirdly, section 5.3 addresses the limitations of the essays and reflects on the barriers faced when conducting the research over the last five years. This is important as it offers a degree of reflection in light of an extensive research process. The thesis is then concluded.

## 5.1 Summary of the Major Findings

This section offers a summary of the main points of the thesis in light of the features of specific literatures. The primary findings from the three essays within this thesis are abridged in the points below.

### **Essay One - Thirty Years of Acquiring Companies: A Review of the Winner's Curse in Bilateral Bargaining**

- The general topic of naïve bidding strategies has become of increasing interest to researchers since the 1980's and swelled between 2002 and 2009. Initially, industrial analysis and the sale of oil leases attracted the attention of researchers interested in the *winner's curse*. The works of William Samuelson and Max Bazerman in 1985 served to extend the domain of analysis from common value auctions to bilateral bargains.
- Over a thirty-year period, the AAC game has provided a crisp method to test whether individuals can foresee the perils of selective acceptance. Since the seminal application of the AAC game in 1985, fifteen further experimental studies have incorporated extensions or adjustments to the basic model. Experimental tests of the problem suggest that the percentage of bidders that submit an optimal bid ranges from 0% to 15% of a sample. The majority of participants suffer from the *winner's curse*. The model has been subject to increasing complexity to test new hypotheses in a laboratory setting, a process which has produced fruitful insights relating to participants' minimal ability to learn and the capacity of irrelevant messages to alter the efficiency of trade. While training participants and group participation can diminish (but not extinguish) naïve bidding strategies, the *winner's curse* in this setting is largely robust to strong learning techniques. The key insights of this model

have practical implications, being applied to managerial decision making and, most recently, ethical decision making.

- Whereas initial research on the AAC problem could be classified as asocial, research trends have investigated strategic nuances of bargaining by incorporating communication into the AAC game. By adopting a between subject design and introducing alternative types of costless pre-play communication, I find that for the first ‘strict’ criterion of the AAC game, a negligible number of participants (4.27%), follow a normative bidding strategy. This is compatible with past studies. For the second criterion, I find no statistically significant differences emerge between alternative cheap talk treatments and bidding behaviour.
- Switching to the seller’s side of the bargain and introducing a preliminary step to the AAC game, I find that seller’s ability to strategically avoid information is limited. This is the first test of irrational behaviour using the AAC game that questioned whether bounded awareness can flow from the opposite direction of the trade. Whereas buyers failed to focus on the decision rules of informed sellers in the AAC game, sellers also mostly fail to foresee the perils of additional information, exhibiting a difficulty in performing contingent reasoning on future events. 78% of the sample followed a naïve strategy and choose to ‘curse themselves’, learning the value of their asset and thereby entering an asymmetric information negotiation setting with a buyer.

## **Essay Two - Winner Alright? High-Stakes Bidding and Returns to Ownership in the UK and Irish Thoroughbred Horseracing Industry**

- Studying bidding behaviour in a naturally occurring auction context, I find evidence that is compatible with the *winner's curse* hypothesis. Ex-post, a high percentage of foals (80%) sold to winning bidders in Irish and English public auctions earn net negative returns. On average, thoroughbreds return a loss of €23,709. Similar losses are recorded across thoroughbred genders. Estimates of a quantile regression model report a statistically significant negative relationship between increases in winning bids and net returns throughout a sample of 1,681 foals. Point estimates from a Huber regression suggest comparable results across the entire distribution.
- Incompatible incentives between owners and trainers and diversification strategies do not mitigate the inefficiencies observed. No notable differences are recorded in returns to thoroughbreds owned and trained by the same parties vis-à-vis those owned and trained by alternative parties. This suggests that moral hazard problems may not be a plausible argument when explaining these losses. Secondly, only two of eighteen owners that purchased more than five horses across the four auctions report positive returns. This finding suggests that diversification strategies do not mitigate net negative returns.
- Whilst a pure disregard for profit maximisation may appear a plausible psychological explanation, overbidding is an ever-present phenomenon in this industry. The findings are compatible with the *winner's curse*



hypothesis. Alternative interpretations relating to utility maximization also offer reasonable explanations for the observed pattern.

### **Essay 3 - Unravelling & Strategic Disclosure: Evidence from the Hospitality Industry**

- The unravelling principle is tested in the hospitality industry by constructing two unique datasets. I verify disclosure decisions for 4,357 hotels across 22 locations globally. The signalling mechanism is created from 4,060,830 TripAdvisor reviews. The key finding is the existence of a downward linear relationship between TripAdvisor scores and voluntary disclosures both regionally and internationally. The strict equilibrium prediction of full information revelation is not observed. An unravelling process is initiated through the disclosure of high-quality signals but a substantial degree of low level disclosure fails to transpire. A partial unravelling result is reported, a finding which is consistent with past work in behavioural science.
- Evaluating interactions between TripAdvisor ratings and star ratings reveals that industry standards may offer hoteliers a reference point from which to make a disclosure decision. Two additional datasets facilitate (i) the consideration of the choice environment and (ii) control for the expectations of a disclosure. The first is from holiday catalogues and shows that disclosure increases considerably in a menu style decision-making context when non-disclosure is noticeable. The second dataset, from an emerging third-party signalling mechanism (also based on eWOM), reveals a similar disclosure pattern occurs in a domain where a disclosure may not be expected. The

results have practical implications for practitioners in the hospitality industry, especially those attempting to improve consumer experiences and parties concerned with the ethics of the industry.

## **5.2 Directions for Future Research**

This section considers possible directions for future research in the light of the three essays. These directions are partitioned according to the primary topic and method of study.

### ***The Winner's Curse in Bilateral Bargaining***

Research on the AAC game, while well-developed, has room for future progress.

The most recent tests of the game have sought to identify grainier characteristics of bidder dispositions such as an individual's communication strategy. Given that communication is an essential feature of bargaining, further studies focussing on communication effects may provide a more nuanced view of how efficient trades are reached and how buyers respond to alternative and more complex types of communications signals.

Experimenting further with the seller's side of the bargain may provide further fruitful insights to the psychological mechanisms important to asymmetric information trades. Experiment II in Essay One represents a first attempt to ask whether sellers foresee the interdependences of a negotiation if given the choice over access to information. Strategically avoiding information is a cognitively challenging task. Developing this line of enquiry could serve to alter the focus of the problem to the seller's side of the bargain.

A bolder line of enquiry involves searching for the boundary conditions of the *winner's curse* in bilateral bargaining and testing the puzzle's sensitivity to contextual changes. One notable observation is that the experimental instructions adopted by researchers assume a default instruction context of '*acquiring a company*'. The vast majority of previous research articles have adopted this identical narrative structure and context to the problem. Since the original formation of the problem, the instructions read by participants establishes a scenario where the buyer is "*currently considering acquiring*" an asset of unknown value. These are three important words. This may act as a subtle cue (embedded in the narrative) that elicits an experimenter demand effect. Specifically, this context establishes a frame of buyer engagement for participants and a momentum toward making a positive bid. Would optimal bidding behaviour emerge if the seller initiated a trade? Further research may concentrate on altering default options and incrementally raising the salience of the adverse selection problem to underline the perils of selective acceptance. Will heightening a buyer's awareness of the problem reduce the incidence of the winner's curse? Would developing an intuitive scenario, to guide participants through the mathematical structure, increase the frequency of optimal bids? These are questions that future research may wish to address.

### ***Auction Environments & Adverse Selection***

Although the switch to studying the *winner's curse* experimentally is associated with confounding field evidence, it will be interesting to question whether the methodological pendulum will swing back. Researchers may place a greater emphasis on field studies in light of the increasing availability of fitting natural conditions and datasets available through online resources to test for the curse. As

Essay Two identifies, the proliferation of data in online markets is allowing researchers to establish increasingly superior measures and more fitting environments to test for overbidding. Naturally, the challenge with these studies is that alternative domains have industry-specific motivations at play. Although arguments concerning informal industry mechanisms have been at the heart of the *winner's curse* (in the auction format) since the original conceptualisation of the idea, it is important for future work to understand industry specific mechanisms to a greater degree and to identify similarities and differences across markets with different institutions. A completely clean test of the *winner's curse* following a real-life auction remains elusive.

### ***The Unravelling Principle & Adverse Selection***

A motivation for this thesis is to develop the literature which considers the economics of disclosure. With a growing number of ranking systems, online review systems and the expansion of internet capabilities, it is likely that disclosure decisions underpinning this principle will become increasingly studied in consumer markets. In turn, this may provide stronger tests of the unravelling principle, which include a time dimension. Given the glut of information relating to consumer products online, analysing marketing strategies in relation to what information firms disclose/do not disclose could be a fruitful area for future research. In Essay Three, I offer conjectures as to why firms may not disclose. Qualitatively detailing the motivations of those that do not report quality information, across industries, is an important issue of for future research.

Furthermore, empirical findings on the failure of unravelling may feedback into the (re)formulation of economic theory. For instance, a key theoretical component of the unravelling principle suggests that whether or not the worst off seller in a market discloses or not does not matter. Rational consumers will make appropriate inferences from non-disclosure once they understand the market environment. Theoretical refinement may be required here.

A growing number of studies, including Essay Three of this thesis, show that non-disclosure, or shrouding of information, is the most likely tactic of the lowest quality seller in a market place. The lowest quality seller does not appear indifferent to disclosure. This empirical observation should be of interest to theoreticians. Later work, while not only empirically testing the unravelling principle in new markets, may focus on refining the principle to incorporate the fact that it is more likely that the lowest quality sellers will have a preference for a non-disclosure strategy.

Research on unravelling may also spur future policy-related papers concerning consumer welfare. If a partial unravelling result is a robust market equilibrium (i.e. is present across markets a variety of markets), such findings may inform policy disputes over information and encourage those seeking greater levels of required disclosure.

### 5.3 Limitations

It is important to be cognisant of the limitations of different aspects of this thesis.

These limitations are most often methodological in nature and are partitioned according to the method of study adopted below, beginning with experimental limitations.

Clearly, the experiments do not employ financial incentives within the design. While incentives are important, the use of monetary incentives is complex and is subject to debate and disciplinary norms (Read, 2005). The costly nature of using incentives within the experimental design is an impediment to their adoption. The prudent use of budgets prevents the use of monetary incentives *within* the design. Despite this limitation, a considerable amount of past evidence shows that the frequency of the *winner's curse* in bilateral bargaining does not differ significantly when financial incentives are employed within the experimental design.

A second limitation of the experimental method adopted is that games played by participants are one-off. It is important to note this as repetition in experimental trials is a common method adopted in experimental economics. Finally, the sample sizes gathered in the experimental settings limit the power of inference one can make regarding the results. While budgetary concerns dictate the sample size for the experiments conducted, one could produce increasingly powerful studies by recruiting higher numbers of participants.

Although the experimental method provides an opportunity to tightly measure specific variables, one loses this control when field studies are pursued. For all of

the advantages of the sizable datasets constructed for Essay Two and Essay Three, several unobservable variables exist which cannot be controlled. Thus, one must be careful when making inferences. While every care is taken to find fitting target environments to explore adverse selection and bounded awareness, it is important to state that neither of the chosen environments are flawless. Naturally, they suffer from drawbacks. For instance, full measurement of returns to thoroughbreds (i.e. the residual stud value) is not possible. Equally, the tests of unravelling in Essay Three are reliant on publically available information. While this makes the study possible, it diminishes the strength of the test. The field environments examined are generally appropriate but they do not offer a panacea to solving all empirical questions.

## **5.4 Conclusion**

In this conclusion I have reviewed and summarised how this thesis advances knowledge by offering insights to strategic decision making, in settings characterised by alternative information conditions, where adverse selection problems can arise. Specifically, this conclusion focusses on reiterating the major empirical findings, evaluating general directions for future research and identifying limitations.

An important component of the empirical insights is the consideration of psychological factors central to adverse selection problems. Whilst for the most part the key contributions of this thesis are empirical, minor methodological contributions are also made. This approach is intended to progress and deepen the connection between psychological approaches in economics and their application to markets characterised by information imperfections. Studying bounded awareness in an economic context is important. Much work is left to be done. With time, it is hoped

that this phenomenon can be considered across a broader range of markets and environments other than those analysed in this thesis.



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## APPENDIX

### Appendix I – Essay One

#### The Acquiring a Company Game (Standard Instructions)

*In the following exercise, you will represent company A (the acquirer) which is currently considering acquiring Company T (the target) by means of a tender offer. You plan to tender in cash for 100% of Company T's shares but are unsure how high a price to offer. The main complication is this: the value of the company depends directly on the outcome of a major oil exploration project it is currently undertaking.*

*The very viability of Company T depends on the exploration outcome. In the worst case (if the exploration fails completely) the company under the current management will be worth nothing - - \$0/share. In the best case (a complete success), the value under current management could be as high as \$100/share. Given the range of exploration outcomes, all share values between \$0 and \$100 per share are considered equally likely. By all estimates the company will be worth considerably more in the hands of Company A than under current management. In fact, whatever the value under current management, the company will be worth 50% more under the management of company A than under company T. In the worst case, the company is worth \$0/share under either management. If the exploration project generates a \$50/share value under company T, the value under company A is \$75/share. Similarly, a \$100/share value under company T implies a \$150/share value under company A, and so on.*

*The board of directors of company A has asked you to determine the price they should offer for Company T's shares. This offer must be made now, before the outcome of the drilling project is known. From all indications, company T would be happy to be acquired by company A, provided it is at a profitable price. You expect company T to delay a decision on your bid until the results of the project are in, then accept or reject your offer before releasing the news of the drilling results to the press.*

*Thus, you (Company A) will not know the results of the exploration project when submitting your price offer, but company T will know the results when deciding whether or not to accept your offer. In addition, company T is expected to accept any offer by company A that is greater or equal to the (per share) value of the company under its own management.*

*As the representative of Company A, you are deliberating over the price offers in the range of \$0/share (this is tantamount to making no offer at all) to \$150/share. What price offer per share would you tender for Company T's stock?*

*My tender price is: \$\_\_\_\_\_ per share. (Samuelson & Bazerman, 1985 P. 29-31).*

## Experiment I Design & Instructions

### Introduction

We would like to thank you for participating in this task. In the following screens you will make a hypothetical decision. You will also be asked basic survey questions. The task should take approximately 6 minutes to complete and we would ask you to take it seriously, complete it alone and in one session.

Please enter your Prolific ID below.

### Stage 1

You and another contestant called Alex have reached the final round of a game show. Both you and Alex's objective is to win as much money as possible. In the final round you both negotiate over the sale of 10 locked boxes. Each box contains a gold coin or is empty. One of you must play as the buyer and the other as the seller. The game show host tosses a coin to randomly determine your role.

\*\*\*

You are the buyer.

### Stage 2

The host brings 10 locked boxes to the stage. All the boxes could be empty; all could contain a gold coin, or anything in between. Every possible number of gold coins is equally likely. The host chose a random number between 0 - 10 at the start of the show and filled the boxes accordingly. Alex, as seller, is gifted the 10 locked boxes by the host.



Gold coins are worth £1,000 to Alex and empty boxes are worthless to you both. In total Alex's boxes could be worth anywhere from £0 (if all the boxes are empty) to £10,000 (if all the boxes have gold coins). If you successfully buy the boxes, the host will give you £1,500 for each gold coin.

### Stage 3

On Alex's request, the host unlocks the boxes. Alex looks inside each box and learns their value.



The host adds one further twist. Before you make a bid for the boxes, Alex can send you one message about how many boxes are empty. Alex can specify any number, and the message need not be correct.

#### Stage 4

Alex says the following number of boxes are empty (0/1/2/4/6)

Alex is claiming the boxes are worth (£10,000/£9,000/£8,000/£6,000/£4,000) to him

#### Stage 5

You will now get an opportunity to make one bid. Your bid is for all of the boxes, you cannot buy individual boxes. If you fail to reach an agreement, Alex keeps the contents of the boxes. Please enter your bid.

Please be aware that you are entitled not to submit a bid. If you wish to refrain from entering the trade submit a bid of £0

#### Stage 6

Contents Revealed

#### Survey

Which one of the following statements was true?

- a. Gold coins were twice as valuable to me.
- b. Alex was required to act truthfully when sending me a message.
- c. The boxes were more likely to be empty than to have gold coins.
- d. Alex learned the true value of the boxes and then sent me a message.

On the scale below, please respond to each of the following statements.

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
Alex's message to me influenced my bid.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
We would be more likely to reach an agreement if Alex did not know the contents of the boxes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

On a scale from 0-10, please rate your own quantitative (mathematical) ability?

Extremely Weak	0	1	2	3	4	5	6	7	8	9	Extremely Strong	10
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>

## Experiment II Design & Instructions

### Stage 1.

You and another contestant called Alex have reached the final round of a game show. Both your group and Alex's objective is to win as much money as possible. In the final round you both negotiate over the sale of 10 locked boxes. Each box contains a gold coin or is empty.

You are the seller and the host gifts you ten locked boxes.

All the boxes could be empty; all could contain a gold coin, or anything in between. Every possible number of gold coins is equally likely. The host chose a random number between 0 - 10 at the start of the show and filled the boxes accordingly.



Gold coins are worth €1,000 to Alex and empty boxes are worthless to you both. In total Alex's boxes could be worth anywhere from €0 (if all the boxes are empty) to €10,000 (if all the boxes have gold coins). If you successfully buy the boxes, the host will give you €1,500 for each gold coin.

### Stage 2.

Before Alex makes a bid you have an option to look inside your boxes. Even if you learn the true value of your boxes, Alex will still not know what is in them. Your decision however (whether or not to look inside the boxes) will be known by Alex.

Yes – I would like to look inside the boxes

No – I would not like to look inside the boxes

Depending on this decision, participants were presented with the following screens.

### Stage 4a.

If yes - The host adds a further twist. Before Alex makes a bid, you can send one message. Your message to Alex will be about how many boxes are empty. You can specify any number you want between 0 and 10. Alex is aware that you are under no obligation to tell the truth. After this message Alex will make one bid.

Please enter a number between 0 to 10 as your message to Alex:

[Regardless of the message] Alex has made a bid of £0 for your boxes. Do you wish to accept or reject this bid?



#### Stage 4b.

If no – Alex has made a bid of £5,000 for your boxes. Do you wish to accept or reject this bid?

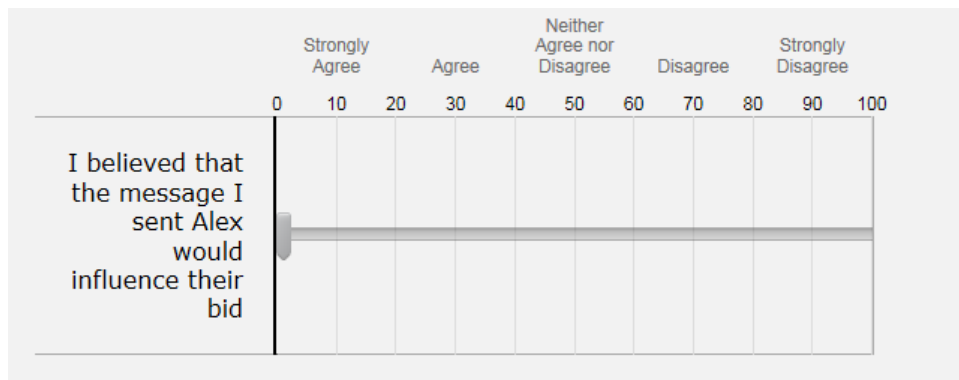
#### Survey

Which one of the following statements was true?

- a. Gold coins were twice as valuable to me.
- b. Individual boxes could contain more than one gold coin.
- c. The boxes were more likely to be empty than to have gold coins.
- d. Alex knew whether or not I looked inside the boxes.

[If Yes] Think back to before Alex made their bid and respond to the following statement.

I believed that the message I sent Alex would influence their bid

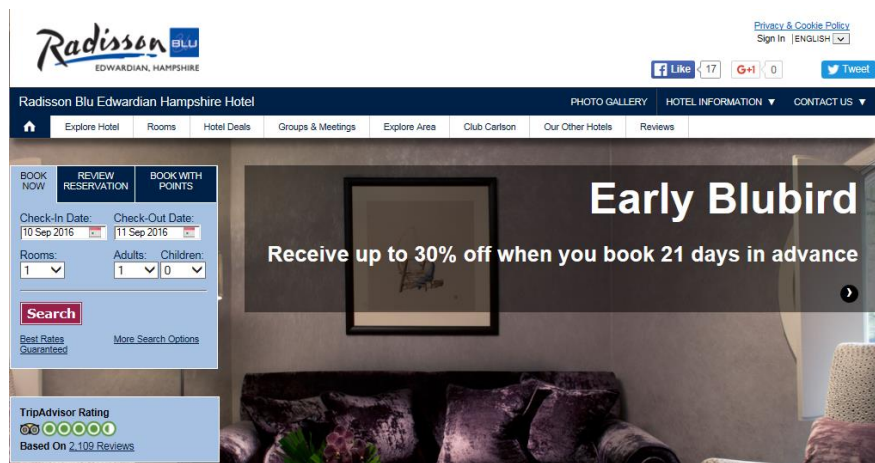


[If Yes] you had any particular reason for sending these messages to Alex, please provide it here.

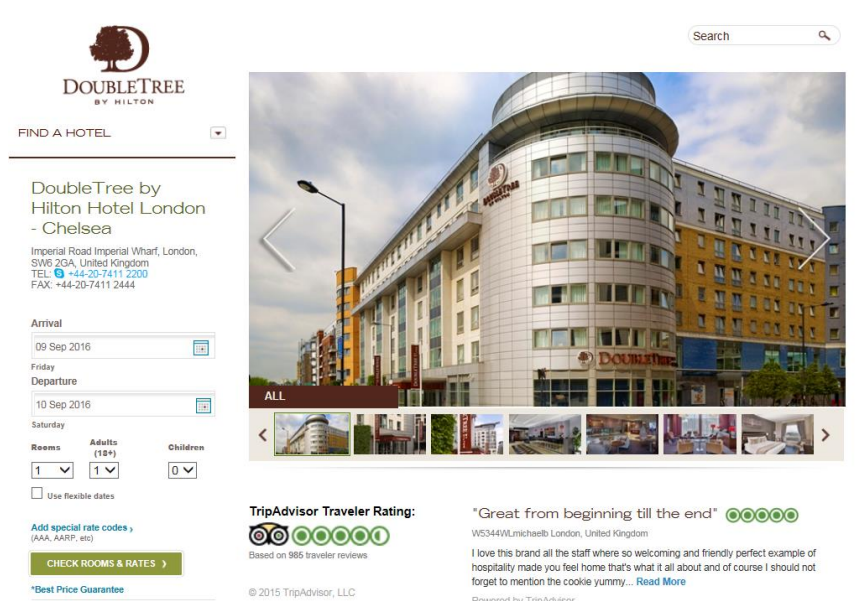
On a scale from 0-10, please rate your own quantitative (mathematical) ability?

## Appendix II – Essay Three

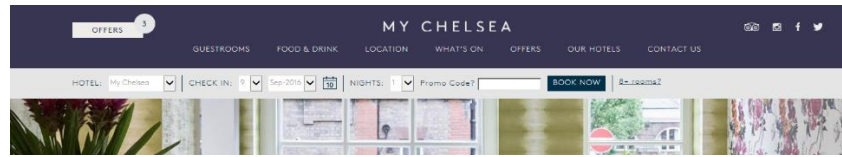
- (i) The score is explicitly published on the website.



- (ii) The score is 'one-click away' or a distinct link exists to their TripAdvisor rating



- (iii) A specific claim to TripAdvisor reviews and performance on the website are made via an inbuilt section of the website.



- (iv) Disclosure (left) and non-disclosure (right) in the context of holiday catalogues

**ALCUDIA BEACH**  
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**CLOSE TO THE BEACH**

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Based on 100 traveller reviews

**rights from £469pp All Inclusive**

Alcudia Beach offers comfortable accommodation with a host of facilities to enjoy. The beach is located just a few minutes walk from the hotel, and the hotel is just a few minutes walk from the beach. For a change of view, the hotel can be found close to the beach, which is a very convenient location.

**ROOM OPTIONS:**  
Double room with 12 beds and new bathroom containing bath, shower, toilet, vanity unit, and a hair dryer. All rooms have air conditioning and are fully equipped.

**BOARDING OPTIONS:**  
Half board, 4 nights only.

**CHILD AGE:** up to 12 years.

**TRANSFER TIME:** approx. 1 hour 45 minutes.

100 rooms, 8 Bays, 1 UK.

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Alcudia

**BELLEVUE CLUB & BELLEVUE CLUB EXTRA**  
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**FREE Wi-Fi**

**ALL INCLUSIVE**

**FAMILY-SIZED ROOMS**

**BELLEVUE CLUB EXTRA AVAILABLE**

**rights from £299pp Self Catering**

Bellevue Club & Bellevue Club Extra offers a range of facilities including eight outdoor pools and a range of sports and entertainment facilities. Bellevue Club & Bellevue Club Extra offers a range of facilities including eight outdoor pools and a range of sports and entertainment facilities. Bellevue Club & Bellevue Club Extra offers a range of facilities including eight outdoor pools and a range of sports and entertainment facilities.

**ROOM OPTIONS:**  
Double room with 12 beds and new bathroom containing bath, shower, toilet, vanity unit, and a hair dryer. All rooms have air conditioning and are fully equipped.

**BOARDING OPTIONS:**  
Half board, 4 nights only.

**CHILD AGE:** up to 12 years.

**TRANSFER TIME:** approx. 1 hour 45 minutes.

100 rooms, 8 Bays, 1 UK.

**BELLEVUE BONITA**  
Alcudia